NASA CONTRACTOR REPORT 166295

Study of Near-Threshold Fatigue Crack Propagation in Pipeline Steels in High Pressure Environments

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M. Mitchell

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Study of Near-Threshold Fatigue Crack Propagation in Pipeline Steels in High Pressure Environments

M. Mitchell
Rockwell International
Science Center
Thousand Oaks, California 91360

Prepared for
Ames Research Center
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NASA
National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035

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INTRODUCTION

This is the final in a series of reports on Near Threshold Fatigue Crack Propagation in Pipeline Steels in High Pressure Environments.

OBJECTIVES

The objective of the program was to determine the level of threshold stress intensity for fatigue crack growth rate behavior in a high strength low alloy (HSLA) X60 pipeline-type steel. Complete results have been generated for gaseous hydrogen at ambient pressure, laboratory air at ambient pressure and approximately 60% relative humidity as well as vacuum of 6.7×10^{-5} Pa ($\lesssim 5 \times 10^{-7}$ torr) at R-ratios = K_{min}/K_{max} of 0.1, 0.5 and 0.8. A concurrent part of the program was to determine fatigue crack growth rate behavior in gaseous hydrogen, methane, and methane plus 10 percent hydrogen at 6.89 MPa (1000 psi).

APPROACH

Material and Specimen Design

Material for use in the program was procurred from Kaiser Steel Corporation in the form of a 1 m × 1 m × 2 cm (~3 ft × 3 ft × 0.75 inch) thick plate. The steel conformed to the requirements of API-5LX-60 high strength low alloy steel (HSLA) and had the composition given in Table 1. Fatigue crack growth specimens of the design shown in Fig. 1 were machined from the plate in the LT direction. Monotonic tension and low cycle fatigue specimens of the design shown in Fig. 2 were also machined from the plate in both the longitudinal and transverse directions. Metallography of samples of the plate revealed a fine, equiaxed grain structure ~10 μm in diameter with "banded" ferrite.

Experimental Procedure

In order to monitor crack growth rates at near threshold stress intensity levels (operationally defined as the stress intensity level at a growth rate of 10^{-6} mm/cycle (4×10^{-7} in/cycle), a D.C. electrical potential system was constructed. Such a crack monitoring system involves a very stable D.C. power supply, current leads mounted to the front face of the fatigue crack propagation (FCP) samples, a set of voltage probes matching the test material composition and a high gain amplifier/digital nanovoltmeter. With such a crack monitoring technique, accuracies of at least 0.1 mm (0.004 inches on absolute crack length are attainable.

To perform the threshold stress intensity level tests, the fatigue crack propagation (FCP) specimens were electrically insulated from the clevis-type gripping system with a set of 6-6 nylon washers and the current leads were securely screwed in place. Voltage leads were secured a priori to the front face of the FCP specimens by spot welding. All testing, including monotonic tension and strain-controlled fatigue tests, was performed in a 140 MPa (20 kip) electrohydraulic closed loop test machine. The test procedure for determining the threshold stress intensity levels was in conformance with ASTM E647-78T.

Special precautions were taken to establish the environments in the case of the vacuum and hydrogen FCP-threshold tests. In the case of the vacuum tests, the test chamber, shown in Fig. 3, was first evacuated with a mechanical roughing pump and back-flushed with ultra-pure argon gas. This procedure was repeated three times. The chamber was then mechanically pumped and diffusion pumped for at least twenty four hours to establish the test vacuum of 1.33×10^{-4} Pa ($<10^{-6}$ torr), typically 4×10^{-5} Pa (3×10^{-7} torr) as well as equilibration of the electrical potential crack monitoring system.

In the case of the hydrogen environment, he same pump/purge with ultra-pure argon procedure was performed. The test chamber, while being pumped with the mechanical pump, was filled with ultrapure gaseous hydrogen that was first filtered through an oil/water filter, an oxygen filter and an

LN_2 cold trap. This procedure was repeated at least three times to establish the test environment for all hydrogen tests.

RESULTS

Ambient Pressure Tests

Monotonic Tension and Low Cycle Fatigue

The monotonic and cyclic stress/strain curves for this steel are shown in Fig. 4. Note that the curves are presented for the longitudinal specimens because no significant difference was apparent from the transverse specimen monotonic results. The cyclic stress/strain curve shown in Fig. 4 was obtained from companion specimen, constant strain amplitude fatigue tests, the results of which are given in Table 2. All monotonic tension and fatigue tests were conducted in a laboratory air environment. It is apparent that cyclic strain softening* occurs at strains less than approximately 0.0045 while cyclic strain hardening occurs at greater strains.

The strain-life fatigue curves obtained from the companion specimen tests are shown in Figs. 5 and 6, respectively, for the longitudinal and transverse rolling directions. Table 3 gives both the monotonic material property data as well as the fatigue property data obtained from these tests.

For comparison to the present results, Table 4 and Fig. 7 show similar data as well as cyclic and strain-life curves for another high strength low alloy (HSLA) steel of approximately comparable hardness. For all practical purposes, the X60 pipeline steel behaves as anticipated and is not unlike similar HSLA steels of comparable hardness.

*The stress required to enforce the strain is less compared to the monotonic response.

Threshold Stress Intensity Levels

Table 5 gives the results of threshold stress intensity ranges, ΔK_{th}, for X60 pipeline-type steel in vacuum 4×10^{-5} Pa (3×10^{-7} torr), air (1×10^{-5} Pa) and gaseous hydrogen (1×10^{-5} Pa) for R-ratios of 0.1, 0.5 and 0.8. Complete plots of da/dN vs ΔK are shown in the Appendix as are complete tabular results of each test. For convenience, tabs with test environment and R-ratio are provided.

Figure 8 shows a plot of threshold stress intensity range, ΔK_{th}, vs R-ratio = K_{min}/K_{max} of all test results, including three generated at M.I.T. as companion tests.* Note that at low R-ratios there is an obvious decrease in ΔK_{th} from vacuum to air to hydrogen. At intermediate R-ratios (approximately 0.5) there is a decrease in ΔK_{th} from vacuum to air and hydrogen. For practical purposes, the hydrogen and air results are the same. Finally note, at high R-ratios (0.8) that there is again a decrease in ΔK_{th} in air and hydrogen as compared with vacuum but as at R = 0.5 the air and hydrogen threshold stress intensity range are essentially the same.

A replot of these data as $K_{th,max} = \frac{\Delta K_{th}}{1 - R}$ vs R-ratio is shown in Fig. 9. Table 6 gives the values of $K_{th,max}$ at the various R-ratios in the three environments. Note that $K_{th,max}$ remains constant as the R-ratio increases to approximately 0.5. Above R = 0.5, $K_{th,max}$ increases abruptly approaching in the limit $K_{max} = K_{critical}$. These trends for this moderately low strength steel are consistent with previously published results and are explained in the Discussion section as follows.

*Prof. R. O. Ritchie, Mass. Inst. Tech., Dept. of Material Science, acted as consultant on this project. S. Suresh supplied the test results. Both are presently with University of California, Dept. of Material Science, Berkeley, Calif.

High Pressure Tests

Three threshold tests were performed by Rocketdyne Division at the Santa Susana Field Laboratory. The first test was performed to check test equipment. Both the potential drop measurement system and the high pressure chamber performed with no apparent problems. The second test was performed at $R = 0.1$ in 6.89 MPa (1000 psi) hydrogen. Analysis of results from this test gave an unexpectedly high threshold value approximately 1.3 times greater than the value in an air environment. Close examination of the system revealed that the high pressure, teflon sliding seals on the hydraulic actuator produced a frictional force in excess of 140 kg (3000 lbs). As a result, frictional forces were greater than specimen loads particularly near threshold levels. Further examination showed that the frictional loads also varied with time as well as in a non-repeatable fashion from seal to seal. Several different seal materials were installed in order to rectify the problem of seal extrusion at the relatively high test frequencies (i.e., 30 Hz). Even seals made of Vespel, a graphite impregnated polyimide that exhibited plastic set, exerted an unpredictable frictional load that varied with time. A final attempt was made to replace sliding pressure seals with high pressure bellows. Many manufacturers were contacted and bellows were ordered with Corporate funds. A third tests was performed in the interim period to ascertain if the test results could be adjusted as a function of time varying frictional forces. Loads were adjusted as a function of time on a test at $R = 0.1$ in 6.89 MPa (1000 psi) hydrogen. As the test progressed, the friction loads decreased in addition to the intentional decrease in machine loads. The decrease in frictional loads (i.e., an increase in specimen loads) offset the decrease in machine loads and the crack growth rate remained steady. A plot of crack growth rate versus stress intensity range is shown in Fig. 10. At low values of ΔK, the growth rate in hydrogen deviates from expected threshold type behavior due to the decreased frictional loads. If, however, the curve is extrapolated (dashed line in figure) to lower growth rates the hypothetical threshold stress intensity range is 2 MPa $\sqrt{m}$ (5.5 ksi $\sqrt{in}$). This value is approximately that expected in a valid high pressure hydrogen test. Although

this procedure allows one to surmise a "reasonable" threshold stress intensity range, it is not the recommended procedure because of the potential for large errors.

All high pressure sliding seals were eventually replaced with bellows and the test system was checked. This, however, occurred long after contract funds were exhausted. The system has been employed subsequently with success for threshold testing of turbine material used in the Space Shuttle Main Engine.

DISCUSSION

From the results presented, Fig. 8, it is apparent that at mid and high R-ratios (i.e., 0.5 and 0.8), where plasticity-induced crack closure and fretting oxidation mechanisms are essentially absent, there is little differences between the values of threshold stress intensity range, ΔK_{th}, for X60 pipeline steel determined in ambient air and gaseous hydrogen. Conversely, at low R-ratios (i.e., R = 0.1), where closure and fretting oxidation are prevalent, the threshold stress intensity range in ambient humidity air is greater than that for gaseous hydrogen. At all R-ratios, both the air and hydrogen threshold stress intensity ranges are less than those gathered in the vacuum environment.

The present results are compatible with results of Suresh, et al (1), for an ASTM A542 Class 2 and 3 (2-1/4 Cr-1 Mo) steel of similar cyclic yield strength to the X60. For a bainitic microstructure, they observed at R = 0.05 that the value of ΔK_{th} in dry H_2 was 5.2 MPa $\sqrt{m}$ (4.7 ksi $\sqrt{in}$) compared with 7.7 MPa $\sqrt{m}$ (7.0 ksi $\sqrt{in}$) in moist air, an increase of 32%. Also similar to the present results, Suresh, et al. found that at R = 0.75 the value of ΔK_{th} in moist air was 3.2 MPa $\sqrt{m}$ (2.9 ksi $\sqrt{in}$) and 3.3 MPa $\sqrt{m}$ (30 ksi $\sqrt{in}$) in dry H_2. Thus, there is a marked acceleration of near-threshold growth rates in H_2 environments at low R-ratios while at high R-ratios H_2 appears to have little influence on crack growth rates in comparison with air environment results.

Figure 11 shows results of yet additional tests on SA516 70 pipeline steel (2). Note in this figure that at low R-ratios and high R-ratios, the behavior of this high strength low alloy steel is exactly the same as the present X60 pipeline steel results.

In the study by Suresh, et al., results were also shown for a normalized bainitic/ferritic, 2-1/4Cr-1Mo steel with a yield strength of 769 MPa (112 ksi) fatigued in a dry helium atmosphere. Threshold stress intensity ranges at R = 0.05 were 7.1 MPa $\sqrt{m}$ (6.5 ksi $\sqrt{in}$) for the moist air environment and 4.9 MPa $\sqrt{m}$ (4.5 ksi $\sqrt{in}$) in the dry helium environment, a decrease of 31%. However, at an R-ratio of 0.75, the threshold stress intensity range was 2.8 MPa $\sqrt{m}$ (2.5 ksi $\sqrt{in}$) and 2.7 MPa $\sqrt{m}$ (2.5 ksi $\sqrt{in}$) in moist air and dry helium, respectively. This is precisely the same trend in behavior exhibited in laboratory air and dry hydrogen. Conventional hydrogen embrittlement effects would therefore appear minimal in comparison to other controlling mechanisms in lower strength steels. Such behavior appears explainable in terms of oxide induced crack closure, a model proposed by Ritchie, et al. (3) and Stewart (R4). In "plasticity induced closure," the crack tip of the material being fatigued is plastically deformed. Because of the constraint of the surrounding elastic material, some closure of crack surfaces can occur at positive R-ratios. If the crack remains partially closed the effective stress intensity range, ΔK_{eff}, is reduced by the amount of the closure stress intensity, K_{Cl} (i.e., $\Delta K_{eff} = K_{max} - K_{Cl}$). But, as the R-ratio is increased, the crack will remain open for a larger portion of the cycle and the effect of plasticity induced closure diminishes. Similarly, in an oxidizing atmosphere, such closure at low R-ratios can provide a mechanism for enhancement of corrosion devices within the crack due to repeated breaking/compaction of the oxide. At high R-ratios such fretting/oxidation mechanisms are absent. As a consequence, at the low R-ratios the excess debris formed will further reduce the threshold stress intensity range because of an "earlier" contact between the cracked surfaces (i.e., K_{Cl} increases thereby reducing ΔK_{eff}).

Although each vacuum threshold stress intensity level is greater than that of air at all R-ratios, the vacuum test results of X60 pipeline steel indicate a pronounced R-ratio effect (i.e., ΔK_{th} decreases monotonically with increase R). This behavior in ΔK_{th} decreasing with R-ratio is in contrast to results observed by Cooke, et al. (R5) for a medium strength, Sy = 1275 MPa (185 ksi), En 24 steel for which ΔK_{th} remained independent of R-ratio. In the test by Cooke, et al., fatigue precracking was done in air and tests were performed "<u>in vacuo</u>" at a frequency of 100 Hz. There is mention in their test technique that a conventional rotary backing pump, an all diffusion pump and an LN_2 cold trap were employed to produce a vacuum of better than 1.33×10^{-3} Pa (10^{-5} torr). This, they considered, adequate "for removal of agressive environmental constituents." Perhaps the difference in the two results lies principally in the establishment of "a vacuum." As may be recalled, the present results for X60 pipeline steel were generated "in vacuo" by backflushing with ultrapure argon. According to Ritchie (6), the typical impurity content of argon is approximately 20-50 ppm water vapor with oxygen, nitrogen and hydrogen being of lesser quantity. This could result in a partial pressure of water vapor constituting a poor vacuum, thus contributing to possible oxide formation.

ACKNOWLEDGEMENTS

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Dr. N. E. Paton, Rockwell International Science Center, acted as program manager for this research. His suggestions, technical discussions, and particularly his patience, are affably acknowledged. Mr. N. Q. Nguyen, presently with Lawrence Laboratories, Livermore, Calif. was responsible for construction of the electrical potential crack monitoring system and initial test results. His support is kindly acknwoledged. Ms. D. Armijo, Ms. M. Spriggs and Mr. A. Murphy were responsible for the test results generated in H_2 and vacuum as well as all final data analysis and reduction. They are gratiously acknowledged.

Prof. R. O. Ritchie, University of California, Berkeley, California, acted as consultant on this program. His valuable and constructive criticism and advice is amiably acknowledged. Mr. J. C. Chesnutt is sincerely thanked for suggestions and technical advice and discussions on methods for improving the testing techniques.

Table 1

Composition of Plate, Weight Percent

C = 0.147	Va = 0.006
Mn = 1.400	Cu = 0.049
P = 0.008	Nb = 0.047
S = 0.012	Al = 0.029
Si = 0.255	Co = 0.014
Cr = 0.008	Mg = 0.003
Mo = 0.240	Ca = 0.010

Table 2

Strain-Life Results for X60 Steel
Transverse and Longitudinal Specimens

Spec. No.	Strain Amplitude, $\Delta\varepsilon/2$	Reversals to Failure, $2N_f$	Steady-State Stress, σ MPa (ksi)	Elastic Strain $\varepsilon_e=\sigma/E$	Plastic Strain $\varepsilon_p=\varepsilon-\sigma/E$
Transverse Specimens					
X60-T1	0.010	484	465.4 (67.5)	0.00225	0.00775
X60-T2	0.005	8.760	396.5 (57.5)	0.00192	0.00308
X60-T3	0.003	34,750	344.7 (50.0)	0.00167	0.00133
X60-T4	0.002	174,160	310.3 (45.0)	0.00150	0.00050
Longitudinal Specimens					
X60-L1	0.010	2,126	473.7 (68.7)	0.00229	0.00771
X60-L2	0.005	12,048	405.4 (58.8)	0.00196	0.00304
X60-L3	0.003	67,340	351.6 (51.0)	0.00170	0.00130
X60-L4	0.002	299,460	317.2 (46.0)	0.00150	0.00050

Table 3

Monotonic and Cyclic Material Property Data
For X60 Pipeline Steel

Monotonic Properties

Brinell Hardness	= 190 HB
Mod. of Elast., E	= 206.8×10^3 MPa (30×10^3 ksi)
Yield Strength, 0.2% S	= 386.1 MPa (56 ksi)
Ultimate Strength, S_u	= 551.6 MPa (80 ksi)
Red. in Area, % RA	= 65.9
True Fract. Duct., ε_f	= 1.08
True Fract. Strength, σ_f (corrected for necking)	= 973.5 MPa (141.2 ksi)
Strain Hardening Exp. n	= 0.15
Strength Coeff., K	= 896.3 MPa (130 ksi)

Cyclic Properties (Long./Trans.)

Yield Strength, 0.2% S_y'	= 368.9/368.9 MPa (53.5/53.5 ksi)
Fatigue Strength Coeff., σ_f'	= 868.7/806.7 MPa (126/117 ksi)
Fatigue Ductility Coeff., ε_f'	= 0.54/0.49
Fatigue Strength Exp., b	= -0.085/-0.080
Fatigue Ductility Exp., c	= 0.55/-0.57
Transition Fatigue Life, $2N_t$	= $3.4 \times 10^4/2.0 \times 10^4$ rev's
Strain Hardening Exp. n'	= 0.146
Strength Coeff., σ_f'	= 903.2 MPa (131 ksi)

Table 4

Material Property Data Sheet

Material:	Gainex*
Condition:	Hot rolled, 3.56 mm (0.140") sheet (150 HB)
Test Cond.:	Room Temp.

Monotonic Properties (Long./Trans.)

Mod. of Elast., E	201.3×10^3 MPa (29.2×10^3 ksi)
Yield Strength, 0.2% S_y	393.0/399.9 MPa (57/58 ksi)
Ultimate Strength, S_u	510.2/530.9 MPa (74/77 ksi)
Red. in Area, % RA	64/58
True Frac. Strength, σ	813.6/806.7 MPa (118/117 ksi)
True Frac. Ductility, ε_f	1.02/0.86
Strain Hard, Exp. n	0.20

Cyclic Properties (Long./Trans.)

Yield Strength, 0.2% S_y'	376.5 MPa (54.58 ksi)
Strain Hard. Exp., n'	0.11
Strength Coeff., K'	786.0 MPa (114 ksi)
Fatigue Strength Coeff., σ_f'	806.7 MPa (117 ksi)
Fatigue Ductility Coeff., ε_f'	0.86
Fatigue Strength Exp., b	-0.071
Fatigue Ductility Exp., c	-0.65
Transition Fat. Life, $2N_t$	1.3×10^4 rev.

Composition (w/o)

C	Mn	P	S	Si	Cu	Ni	Cr	Mo	N
0.16	0.90	0.038	0.027	0.04	0.10	0.01	0.01	0.01	0.017

*Trade Name of Armco Steel

Table 5

Threshold Stress Intensity Range, ΔK_{th} of X60 Pipeline type Steel (LT Orientation)

R \ Env.	Vacuum 6.7×10^{-5} Pa	Air 1×10^{5} Pa	Hydrogen 1×10^{5} Pa
0.1	10.2 MPa $\sqrt{m}$ (9.3 ksi $\sqrt{in}$) Spec. No. X60-13	7.9 MPa $\sqrt{m}$ (7.2 ksi $\sqrt{in}$) Spec. No. X60-05	5.6 MPa $\sqrt{m}$ (5.2 ksi $\sqrt{in}$) Spec. No. X60-24
0.5	6.1 (5.6) X60-14	3.1 (2.8) X60-04	3.7 (3.4) X60-26
0.8	6.6 (6.1) X60-22	2.5 (2.3) X60-06	3.3 (3.0) X60-23

Table 6

$K_{th,max}$ Values for X60 Pipeline Type Steel

$$K_{th,max} = \left[\frac{\Delta K_{th}}{1 - R}\right]$$

R \ Env.	Vacuum 6.7×10^{-5}	Air 1×10^{5} Pa	Hydrogen 1×10^{5} Pa
0.1	11.3 MPa $\sqrt{m}$ (10.3 ksi $\sqrt{in}$)	8.8 MPa $\sqrt{m}$ (8.0 ksi $\sqrt{in}$)	6.2 MPa $\sqrt{m}$ (5.7 ksi $\sqrt{in}$)
0.5	12.2 (11.2)	6.2 (5.6)	7.4 (6.8)
0.8	33.0 (30.5)	12.5 (11.5)	16.5 (15.0)

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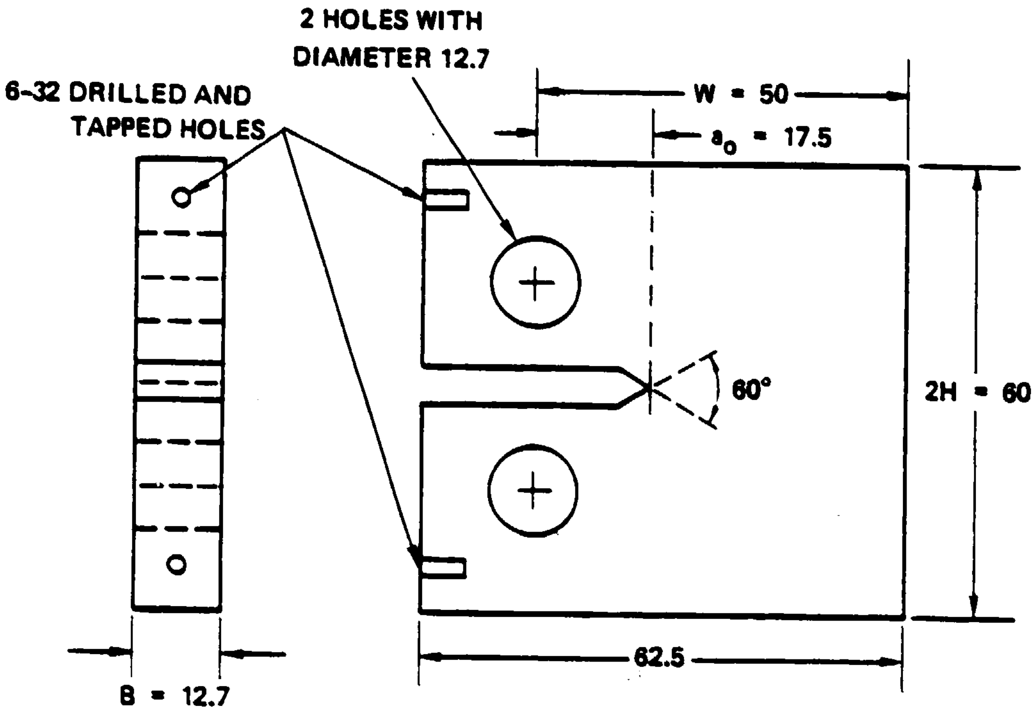

ALL DIMENSIONS IN mm

COMPACT (CT) FATIGUE TESTPIECE

$H/W = 0.60$

$B = 12.7$ mm (0.50 in)

$W = 50$ mm (1.97 in)

$a_o/W = 0.35$

Fig. 1 Fatigue crack growth specimen.

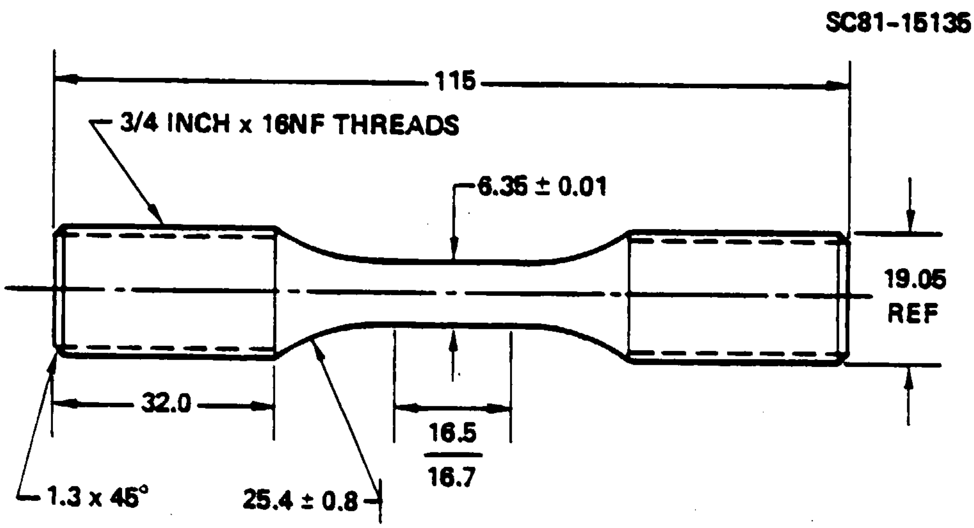

Fig. 2 Tension and fatigue specimen design.

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH

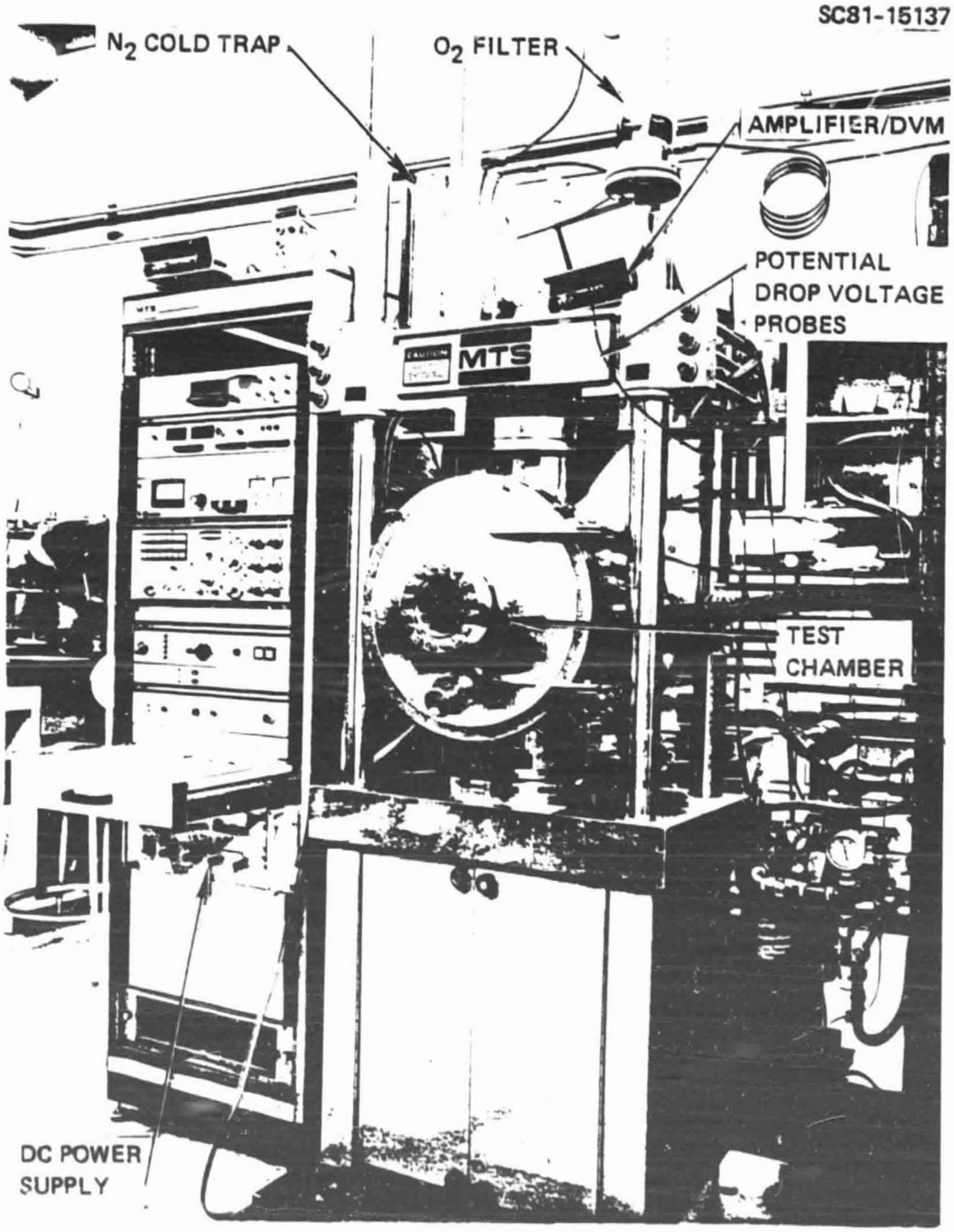

Fig. 3 Test chamber.

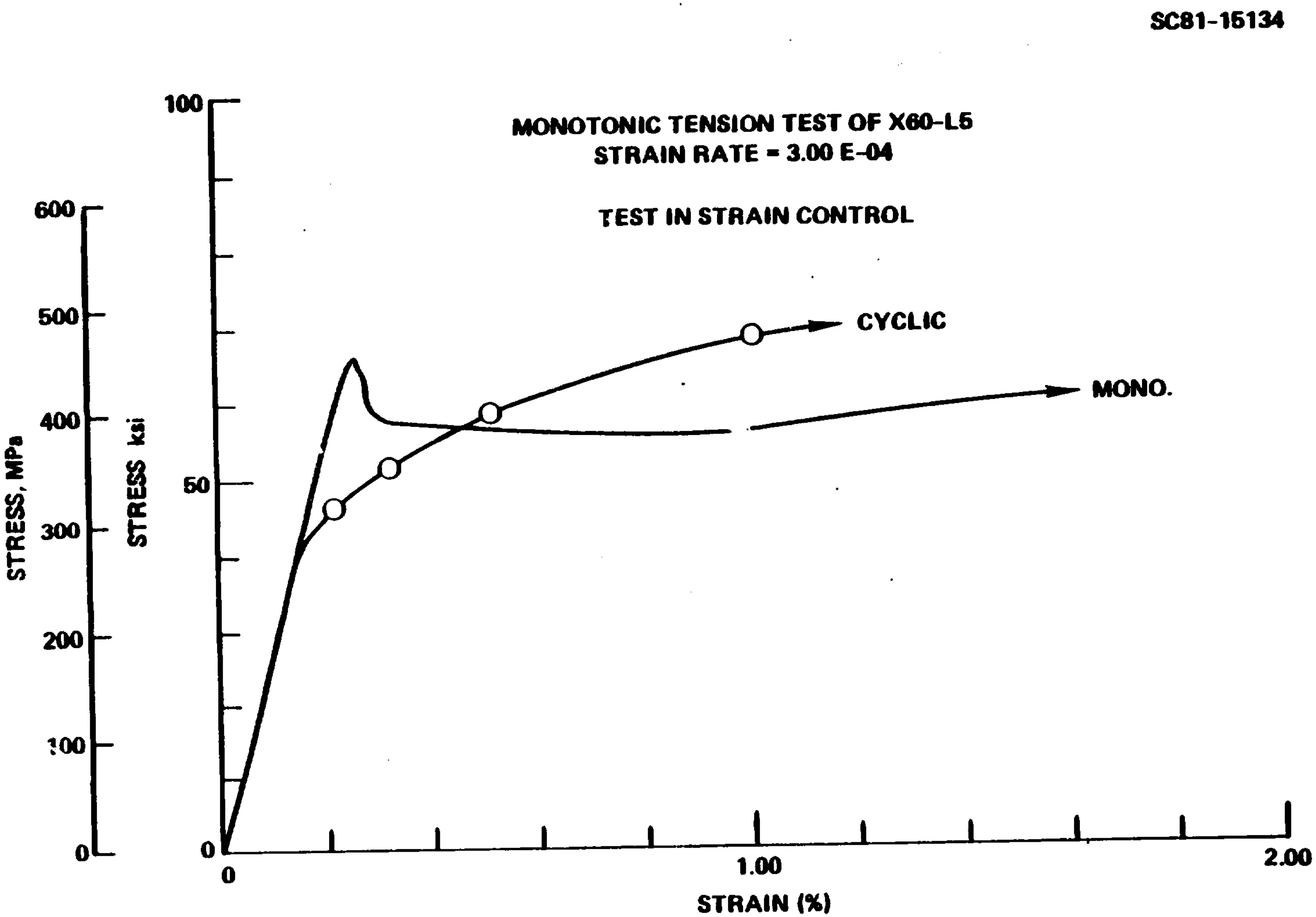

Fig. 4 Monotonic and cyclic stress-strain curves for X60 pipeline steel.

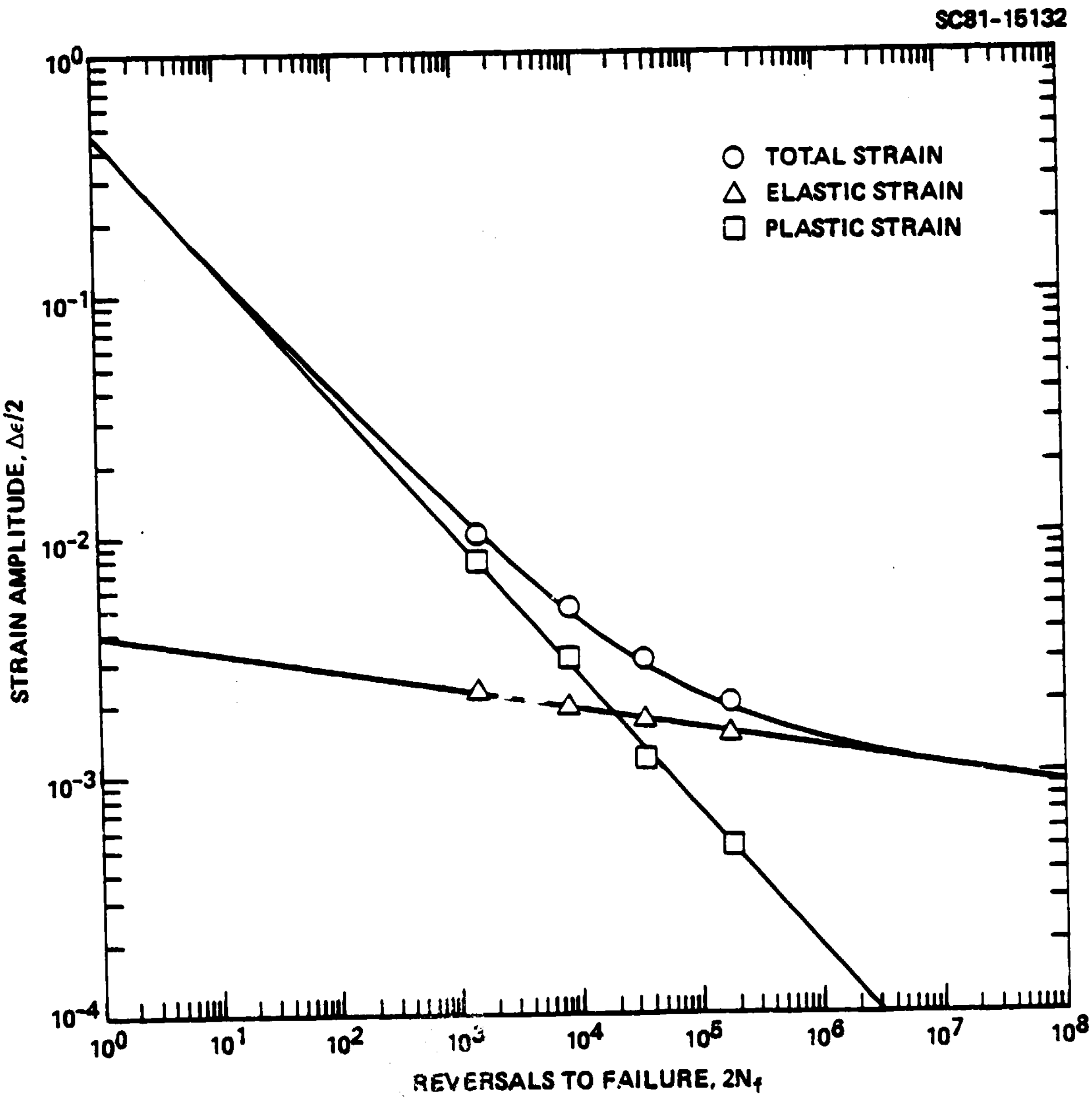

Fig. 5 Strain-life curve for X60 pipeline steel (longitudinal).

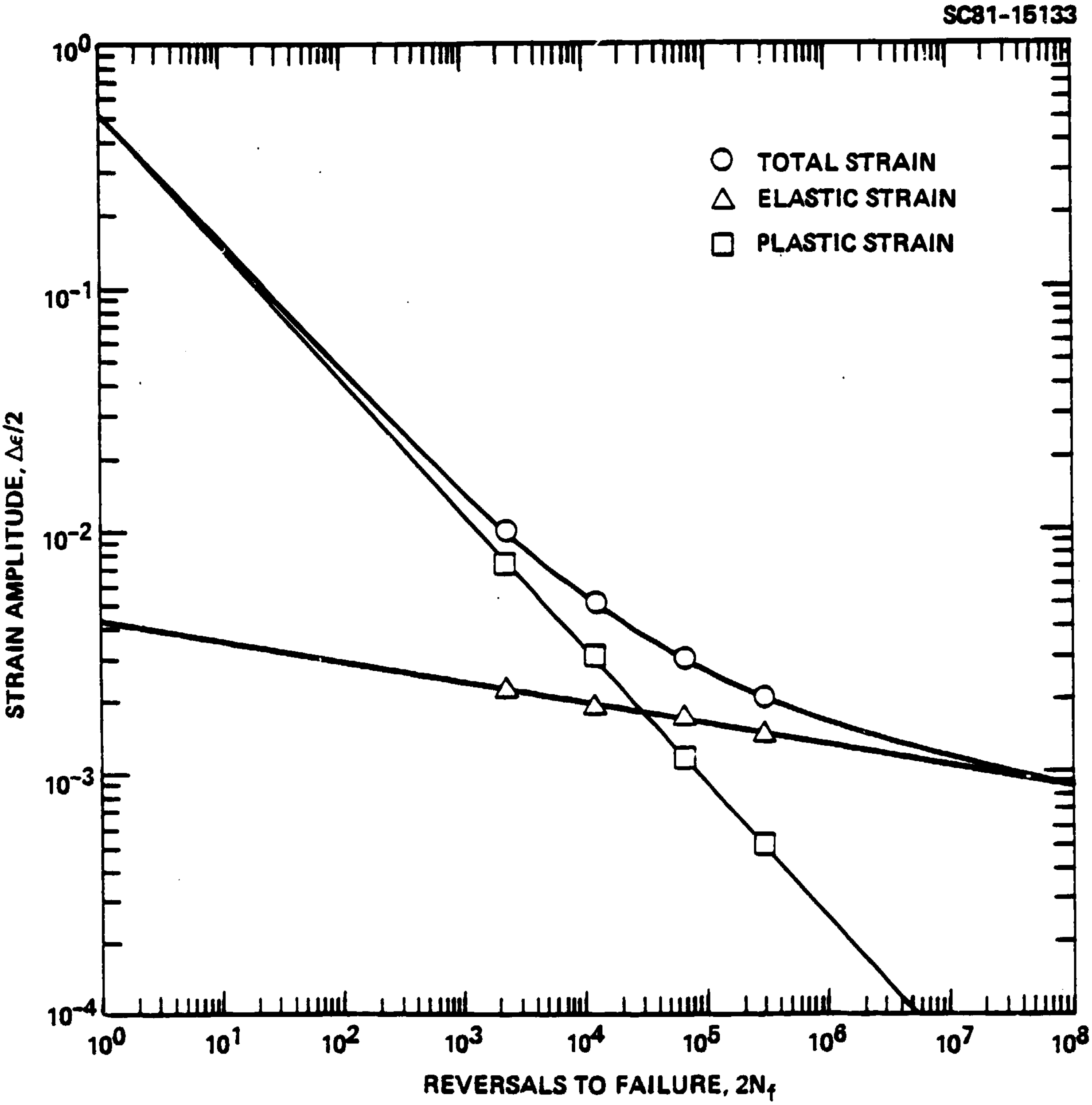

Fig. 6 Strain-life curve for X60 pipeline steel (transverse).

MATERIAL: GAINEX

CONDITION: HOT ROLLED, 3.56 mm (0.140") SHEET (150 HB)

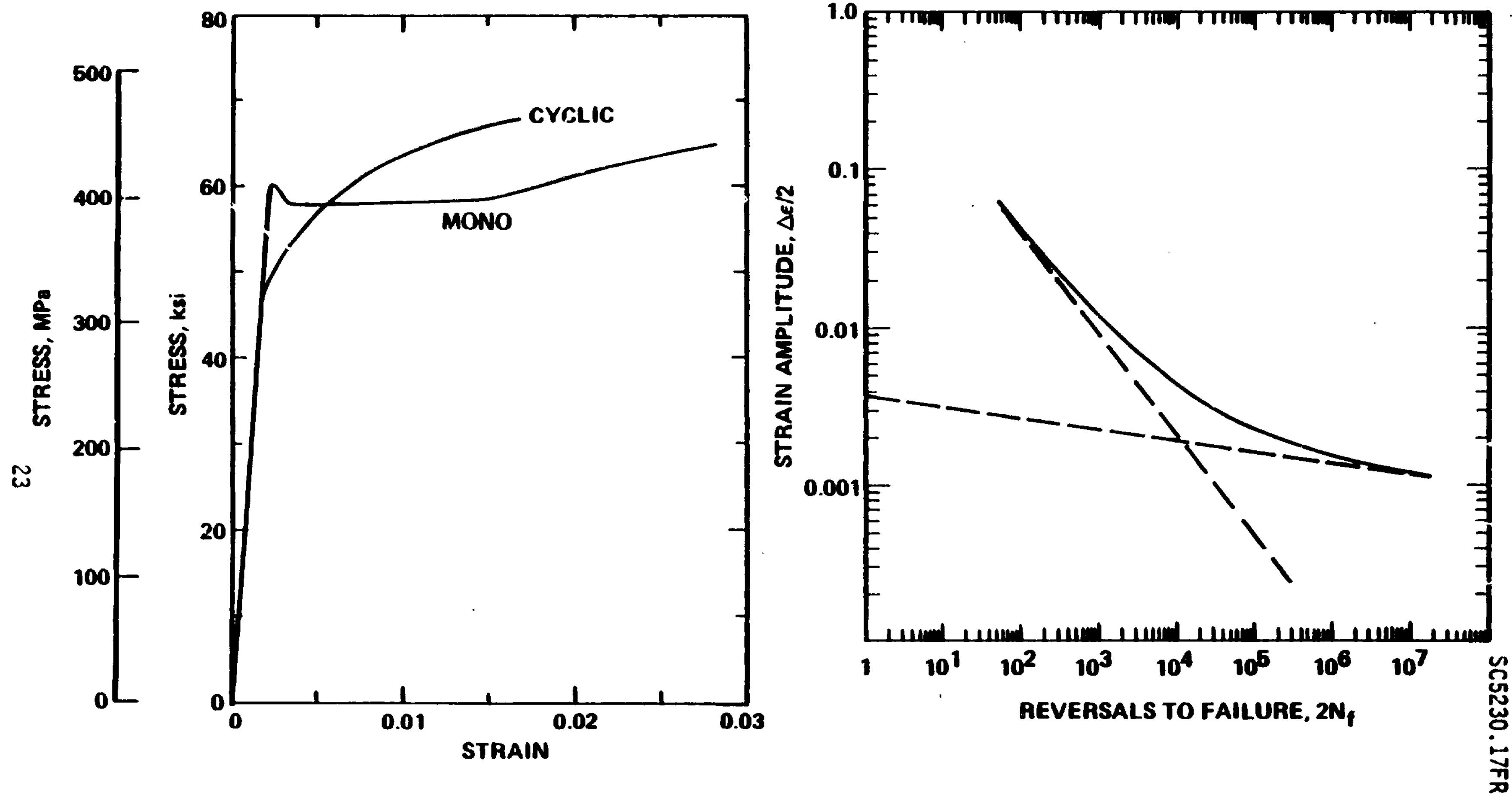

Fig. 7 Monotonic, cyclic and strain-life curves for Gainex* steel.
*Trade name of Armco steel.

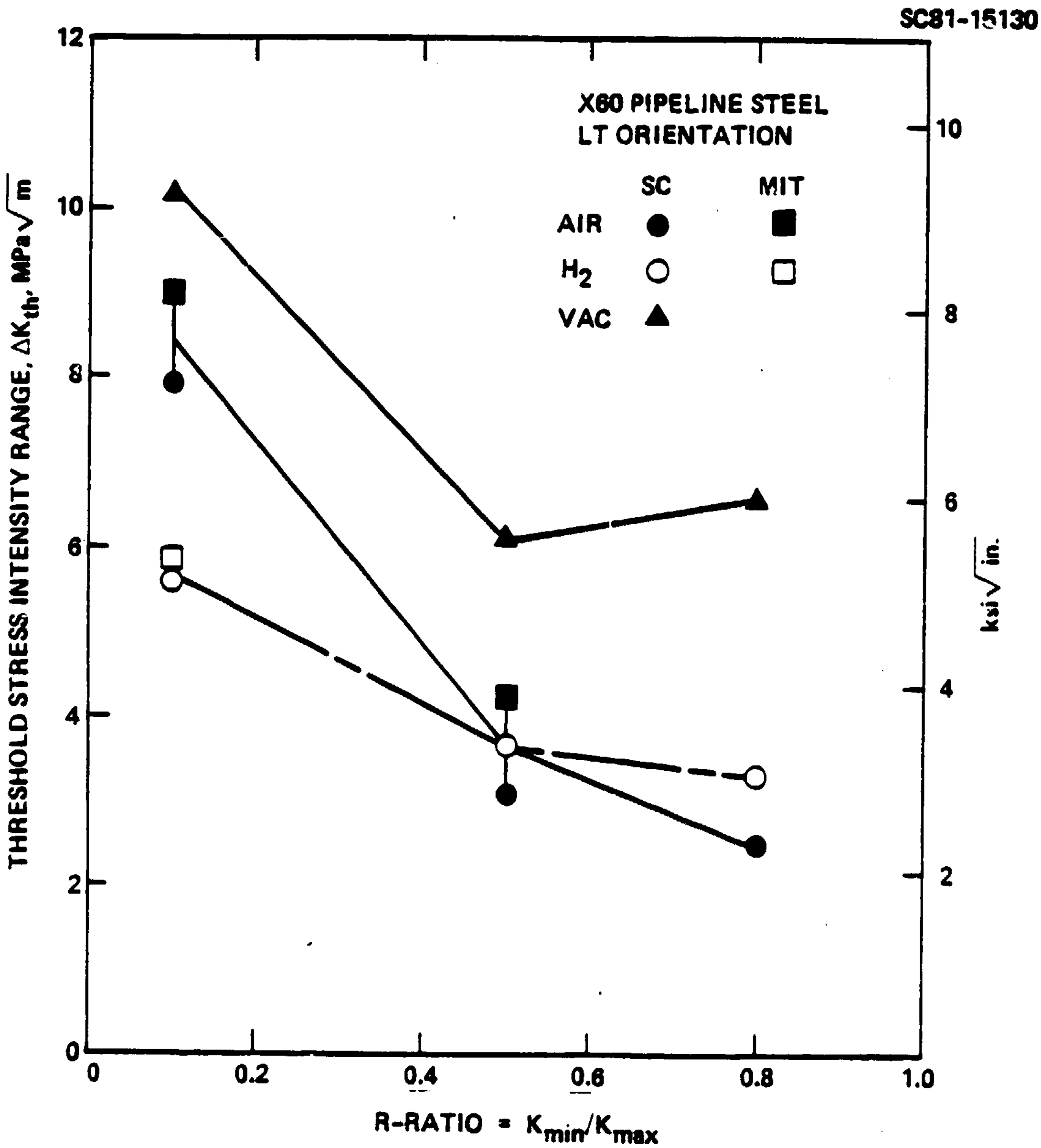

Fig. 8 Threshold stress intensity range vs R-ratio for X60 pipeline steel.

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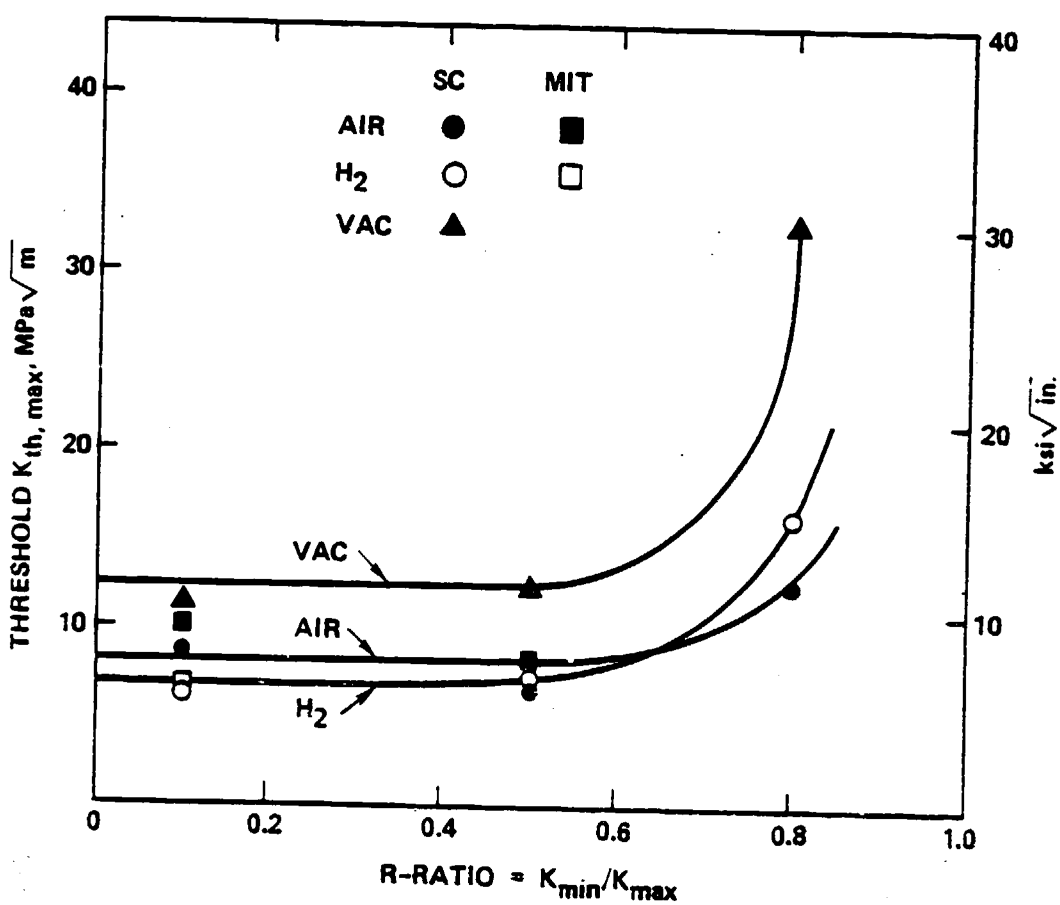


Fig. 9 $K_{th,max}$ vs R-ratio for X60 pipeline steel.

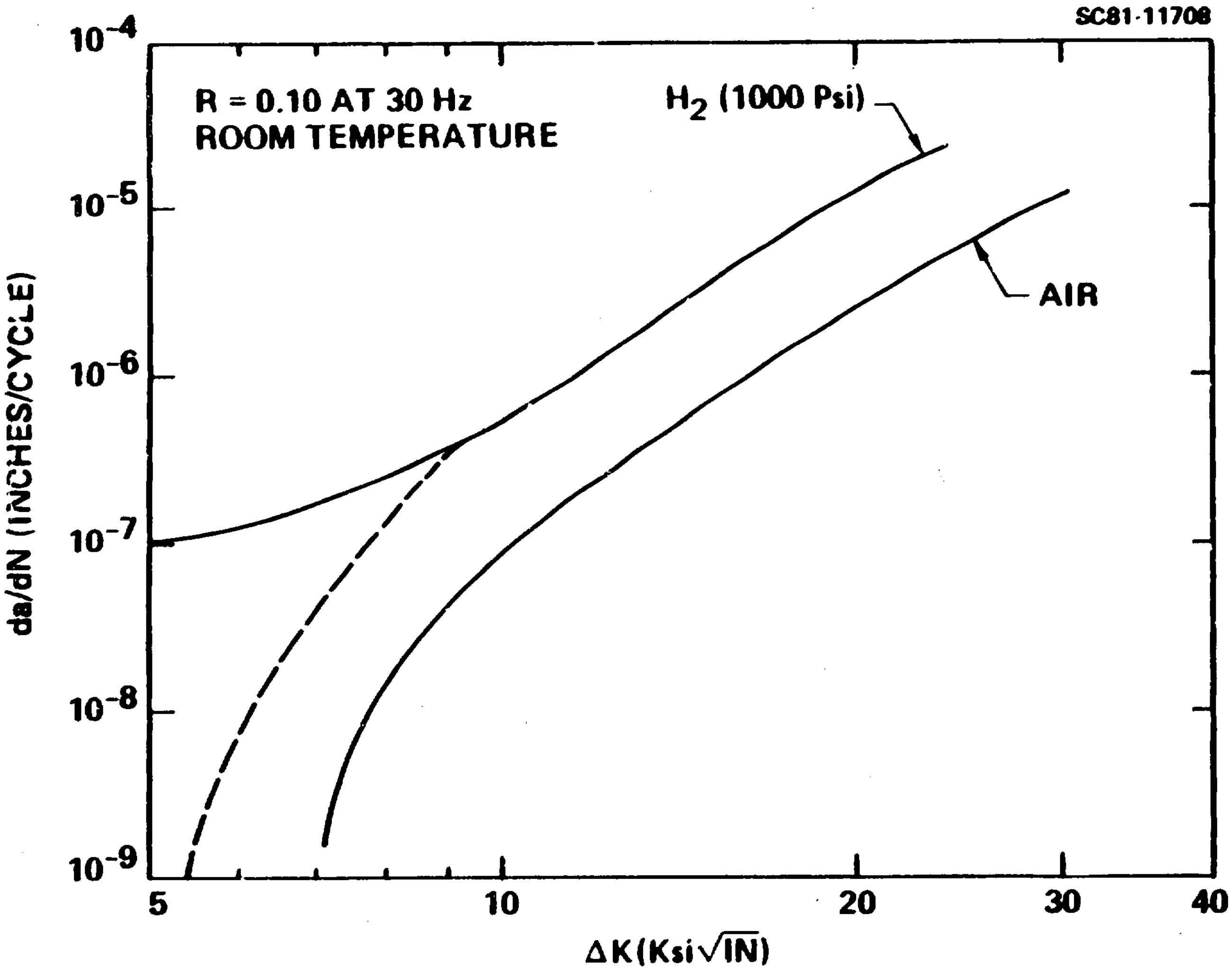


Fig. 10 da/dN vs ΔK at high pressure for X60 pipeline steel.

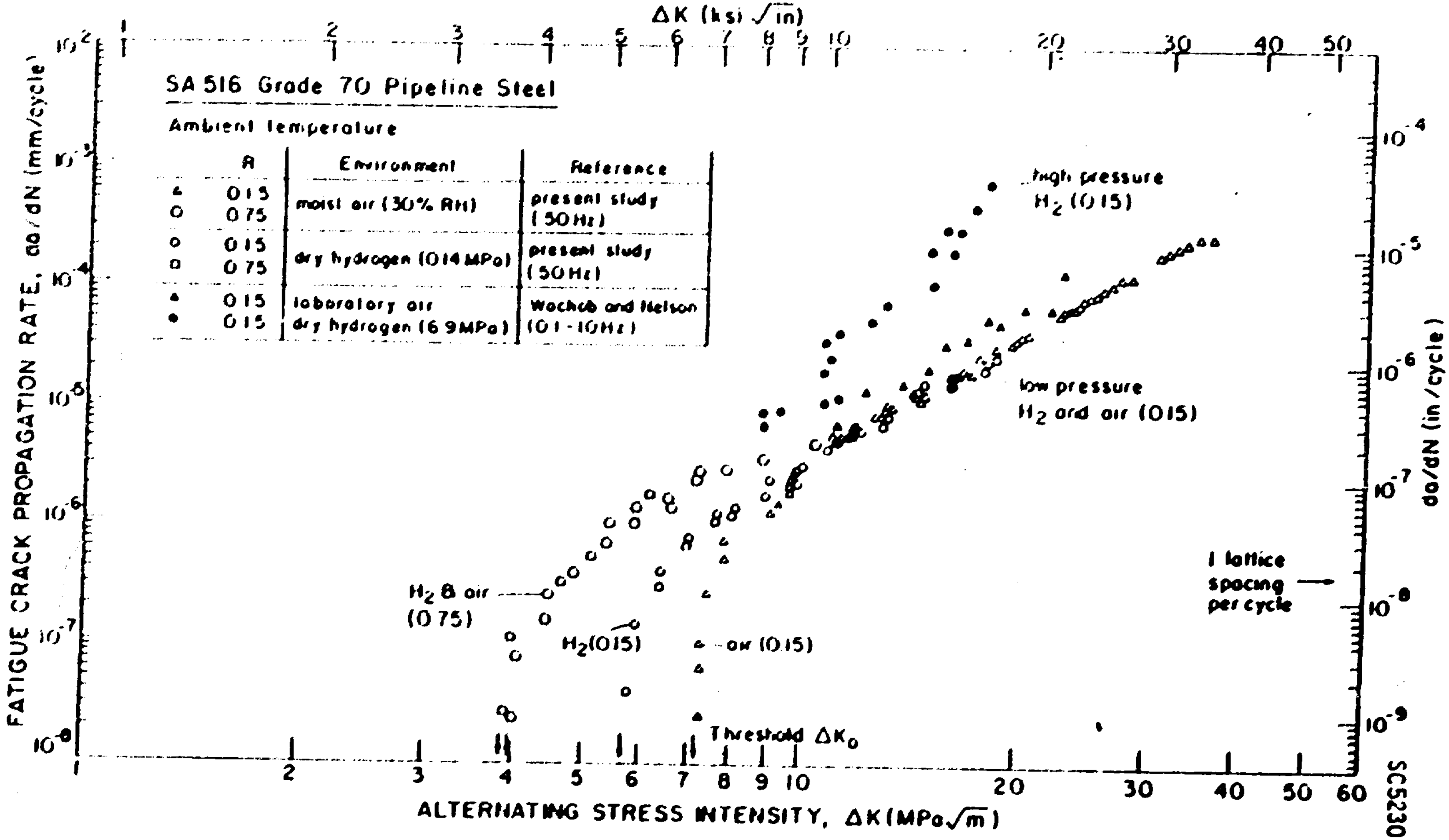


Fig. 11 da/dN vs ΔK for a Grade 70 pipeline steel.

SC5230.17FR

Vac; $R = 0.1$

SPECIMEN NO.: X60-13
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .1 @ 35 HZ
TEST ENVIRONMENT: VACUUM
DATA FILE : X6013 G.O. NUMBER: 5230
18-JUNE-1980

OBS. NO.	DELTA-N	CRACK LENGTH (INCH)	P-MAX (KIPS)	DELTA-A (INCH)
1	1.00000E+06	.175	1.2	.055
2	1.00000E+06	.181	1	6.00000E-03
3	1.00000E+07	.19	.9	9.00000E-03
4	2.00000E+06	.225	1	.035
5	1.90000E+06	.292	1	.067
6	500000	.334	1	.042
7	250000	.36	1	.026
8	150000	.375	1	.015
9	150000	.393	1	.018
10	150000	.413	1	.02
11	150000	.435	1	.022
12	100000	.451	1	.016
13	75000	.466	1	.015
14	75000	.486	1	.019
15	50000	.5	1	.014
16	50000	.515	1	.015
17	50000	.532	1	.018
18	50000	.556	1	.024
19	25000	.571	1	.015
20	25000	.588	1	.017

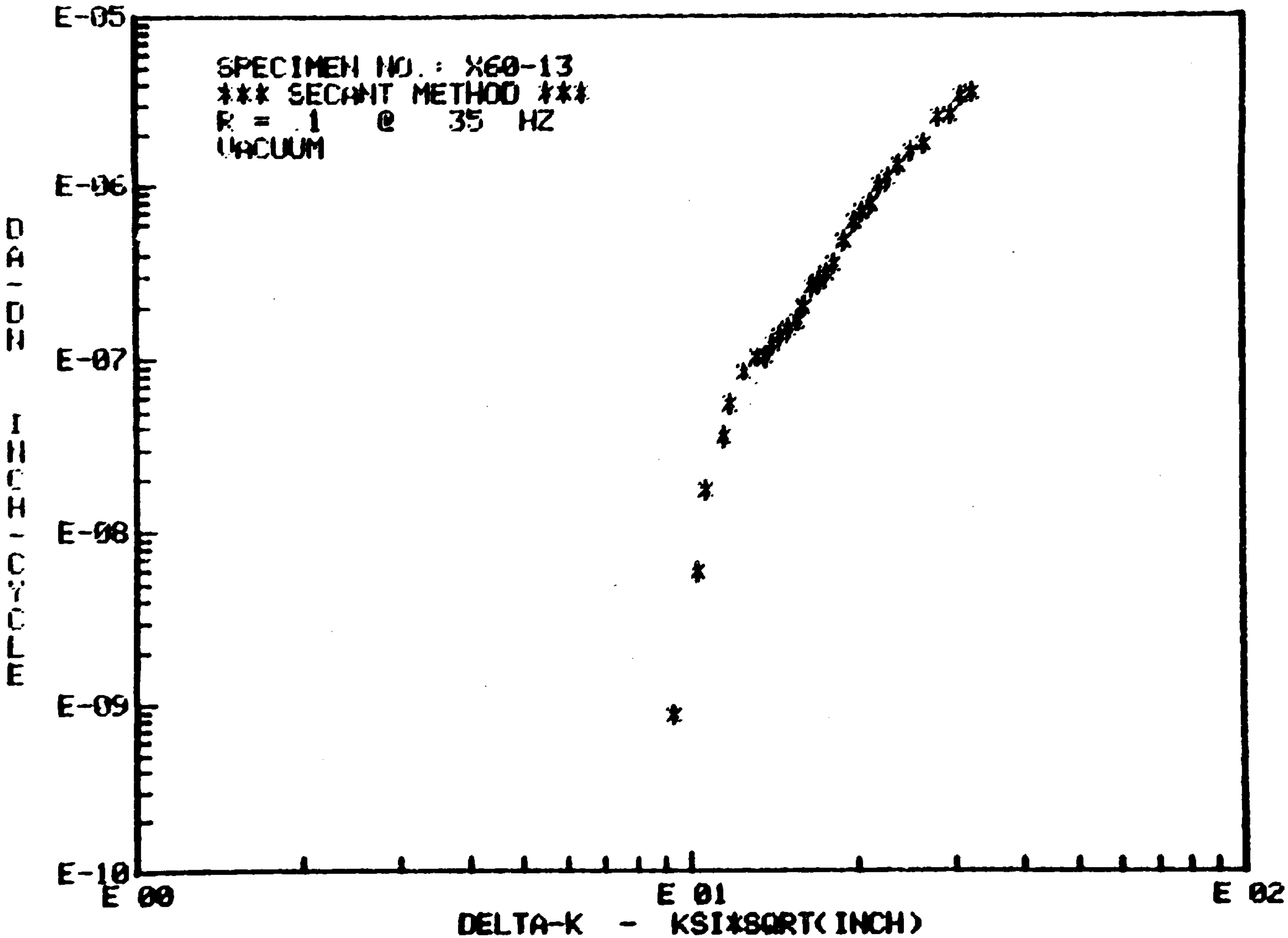
21	20000	.604	1	.015
22	15000	.619	1	.015
23	15000	.635	1	.017
24	15000	.655	1	.02
25	15000	.678	1	.023
26	10000	.695	1	.017
27	10000	.72	1	.025
28	5000	.733	1	.013
29	5000	.75	1	017
30	5000	.767	1	.018

*** SECANT METHOD ***

SPECIMEN NUMBER: X60-13
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .1 @ 35 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6013 G.O. NUMBER: 5230

OBS. NUMBER	DELTA-N	DELTA-A (INCH)	A (INCH)	DELTA-K KSI*SQRT(INCH)	DA/DN INCH/CYCLE
1	1.00000E+06	.055	.847	11.844	5.54450E-08
2	1.00000E+06	6.00000E-03	.878	10.294	6.03790E-09
3	1.00000E+07	9.00000E-03	.885	9.361	8.80300E-10
4	2.00000E+06	.035	.907	10.725	1.74890E-08
5	1.90000E+06	067	.958	11.546	3.52363E-08
6	500000	.042	1.013	12.543	8.41360E-08
7	250000	.026	1.047	13.235	1.02260E-07
8	150000	.015	1.067	13.687	1.03267E-07
9	150000	.018	1.084	14.073	1.18514E-07
10	150000	.02	1.103	14.534	1.33373E-07
11	150000	.022	1.124	15.081	1.47697E-07
12	100000	.016	1.143	15.614	1.64940E-07
13	75000	.015	1.159	16.069	1.97680E-07
14	75000	.019	1.176	16.593	2.58400E-07
15	50000	.014	1.193	17.131	2.77420E-07
16	50000	.015	1.207	17.627	3.05579E-07
17	50000	.018	1.224	18.217	3.52440E-07
18	50000	.024	1.244	19.005	4.70940E-07
19	25000	.015	1.264	19.799	6.05240E-07
20	25000	.017	1.28	20.51	6.94282E-07

21	20000	.015	1.296	21.27	7.66000E-07
22	15000	.015	1.311	22.012	9.85730E-07
23	15000	.017	1.327	22.832	1.10220E-06
24	15000	.02	1.345	23.841	1.30260E-06
25	15000	.023	1.366	25.14	1.55447E-06
26	10000	.017	1.387	26.483	1.73310E-06
27	10000	.025	1.408	28.01	2.49431E-06
28	5000	.013	1.427	29.504	2.57879E-06
29	5000	.017	1.442	30.767	3.34840E-06
30	5000	.018	1.459	32.344	3.51640E-06



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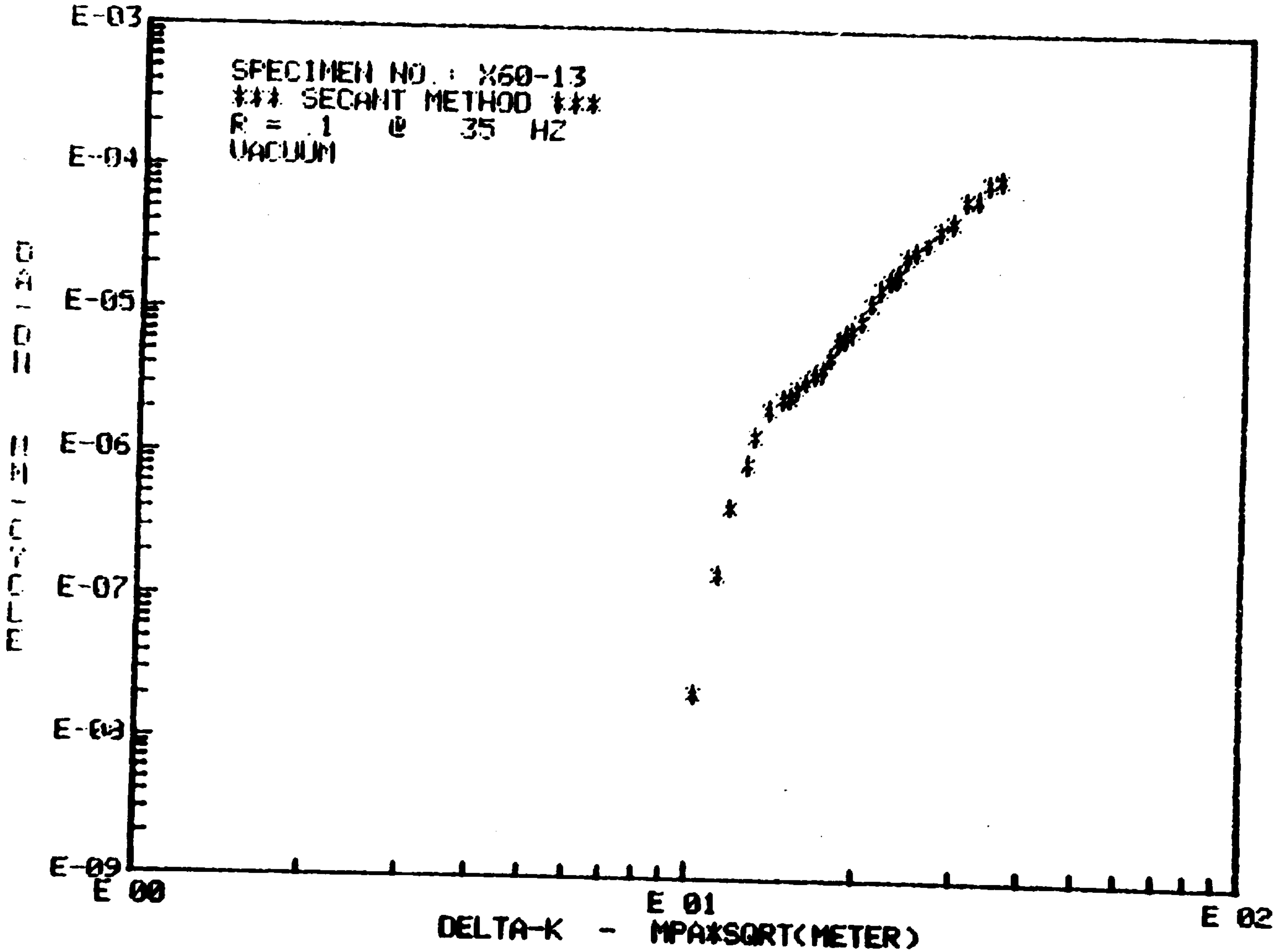
SC5230.17FR

SPECIMEN NO. : X60-13
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .1 @ 35 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6013 G.O. NUMBER 5230
18-JUNE-1980

OBS. NO.	DELTA-N	CRACK LENGTH (MM)	P-MAX (NEWTONS)	DELTA-A (MM)
1	1.00000E+06	4.445	5329	1.408
2	1.00000E+06	4.599	4440	.153
3	1.00000E+07	4.822	3996	.224
4	2.00000E+06	5.711	4440	.888
5	1.90000E+06	7.414	4440	1.703
6	500000	8.483	4440	1.069
7	250000	9.132	4440	.649
8	150000	9.526	4440	.393
9	150000	9.977	4440	.452
10	150000	10.485	4440	.508
11	150000	11.049	4440	.563
12	100000	11.468	4440	.419
13	75000	11.844	4440	.377
14	75000	12.336	4440	.492
15	50000	12.689	4440	.352
16	50000	13.077	4440	.388
17	50000	13.524	4440	.448
18	50000	14.123	4440	.598
19	25000	14.507	4440	.384
20	25000	14.948	4440	.441

21	20000	15.337	4440	.389
22	15000	15 712	4440	.376
23	15000	16.132	4440	.42
24	15000	16.629	4440	.496
25	15000	17.221	4440	.592
26	10000	17.661	4440	.44
27	10000	18.295	4440	.634
28	5000	18.622	4440	.328
29	5000	19 047	4440	.425
30	5000	19.494	4440	.447


SPECIMEN NO. : X60-13
*** SECANT METHOD ***
R = .1 @ 35 HZ
VACUUM
DA/DN MM/CYCLE
DELTA-K - MPA*SQRT(METER)
E-03
E-04
E-05
E-06
E-07
E-08
E-09
E 00
E 01
E 02

*** SECANT METHOD ***

SPECIMEN NUMBER: X60-13
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .1 @ 35 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6013 G.O. NUMBER: 5230

OBS. NUMBER	DELTA-N	DELTA-A (MM)	A (MM)	DELTA-K MPA*SQRT(METER)	DA/DN (MM/CYCLE)
1	1.00000E+06	1.408	21.521	12.9901	1.40830E-06
2	1.00000E+06	.153	22.302	11.2907	1.53340E-07
3	1.00000E+07	.224	22.491	10.2669	2.23723E-08
4	2.00000E+06	.888	23.047	11.7635	4.44195E-07
5	1.90000E+06	1.703	24.342	12.6638	8.96526E-07
6	500000	1.069	25.728	13.7571	2.13705E-06
7	250000	.649	26.587	14.5161	2.59749E-06
8	150000	.393	27.109	15.012	2.62297E-06
9	150000	.452	27.531	15.4354	3.01024E-06
10	150000	.508	28.011	15.9415	3.38769E-06
11	150000	.563	28.547	16.5409	3.75633E-06
12	100000	.419	29.038	17.1252	4.18947E-06
13	75000	.377	29.436	17.6246	5.02107E-06
14	75000	.492	29.87	18.1992	6.56336E-06
15	50000	.352	30.293	18.7891	7.04647E-06
16	50000	.388	30.663	19.3335	7.76171E-06
17	50000	.448	31.081	19.9811	8.95197E-06
18	50000	.598	31.603	20.8449	1.19619E-05
19	25000	.384	32.095	21.7156	1.53731E-05
20	25000	.441	32.507	22.4955	1.76348E-05

21	20000	.389	32.922	23.3287	1.94564E-05
22	15000	.376	33.305	24.1432	2.50375E-05
23	15000	.42	33.702	25.0423	2.79959E-05
24	15000	.496	34.16	26.1491	3.30860E-05
25	15000	.592	34.705	27.5734	3.94835E-05
26	10000	.44	35.221	29.0469	4.40207E-05
27	10000	.634	35.758	30.7221	6.33554E-05
28	5000	.328	36.238	32.3603	6 55014E-05
29	5000	.425	36.615	33.7457	8.50491E-05
30	5000	.447	37.051	35.4751	8 93166E-05

Vac; $R = 0.5$

SPECIMEN NO.: X60-14
DIMENSION (INCH): B = .5 W = 2
2H = 2.3 A(N) = .7
R-RATIO = .5 @ 35 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE: X6014 G.O. NUMBER: 5230
7-JULY-1980

OBS. NO.	DELTA-N	CRACK LENGTH (INCH)	P-MAX (KIPS)	DELTA-A (INCH)
1	350000	.179	1.9	.029
2	500000	.219	1.8	.04
3	1.00000E+06	.254	1.5	.035
4	1.02000E+06	.275	1.3	.021
5	2.00000E+06	.306	1.16	.031
6	1.00000E+06	.314	1	8.00000E-03
7	2.00000E+06	.32	.9	6.00000E-03
8	5.00000E+06	.321	.8	1.00000E-03
9	5.00000E+06	.331	.85	.01
10	3.85000E+06	.351	.9	.021
11	2.00000E+06	.37	.9	.019
12	1.00000E+06	.385	1	.014
13	350000	.393	1.1	9.00000E-03
14	350000	.405	1.1	.011
15	300000	.42	1.2	.015
16	200000	.431	1.2	.012
17	100000	.441	1.3	9.00000E-03
18	100000	.452	1.3	.011
19	75000	.464	1.4	.012
20	75000	.477	1.4	.013

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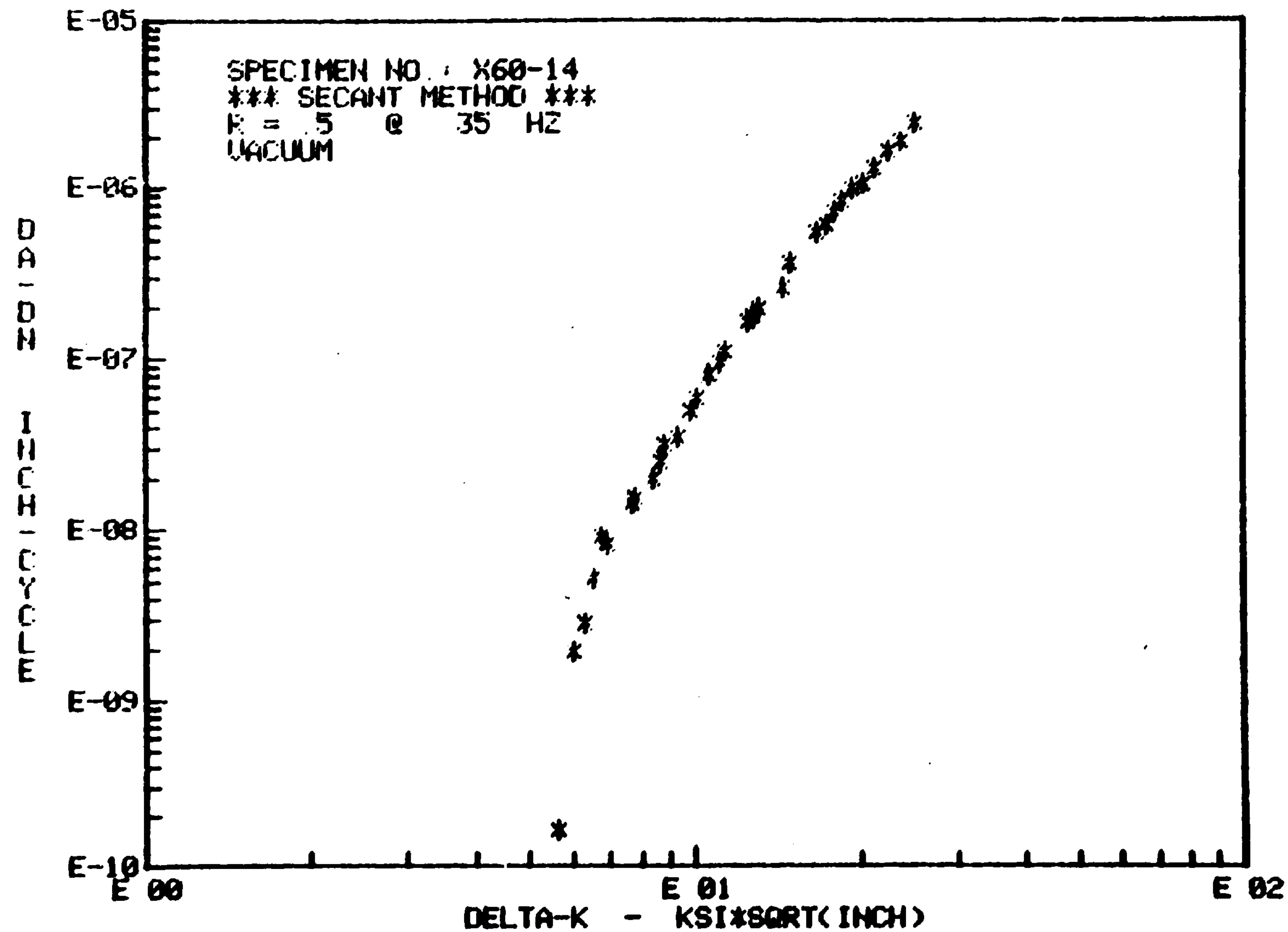
21	75000	.492	1 4	.015
22	50000	.505	1.5	.013
23	50000	.523	1.5	.018
24	50000	.55	1.6	.027
25	25000	.565	1.6	015
26	20000	.579	1.6	.014
27	20000	.596	1.6	.016
28	20000	.615	1.6	.019
29	20000	.636	1.6	.021
30	15000	.656	1.6	.019
31	15000	.68	1.6	.025
32	10000	.699	1.6	019
33	10000	.723	1.6	.024

*** SECANT METHOD ***

SPECIMEN NUMBER: X60-14
DIMENSION (INCH): B = .5 W = 2
2H = 2.3 A(N) = .7
R-RATIO = .5 @ 35 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6014 G.O. NUMBER: 5230

OBS. NUMBER	DELTA-N	DELTA-A (INCH)	A (INCH)	DELTA-K KSI*SQRT(INCH)	DA/DN INCH/CYCLE
1	350000	.029	.865	10.673	8.15886E-08
2	500000	.04	.899	10.601	7.91560E-08
3	1.00000E+06	.035	.936	9.318	3.50770E-08
4	1.02000E+06	.021	.964	8.413	2.02539E-08
5	2.00000E+06	.031	.99	7.806	1.56600E-08
6	1 00000E+06	8.00000E-03	1.01	6.938	8.36200E-09
7	2.00000E+06	6.00000E-03	1.017	6.314	2.91300E-09
8	5.00000E+06	1.00000E-03	1.021	5.642	1.66404E-10
9	5.00000E+06	.01	1.026	6.045	1.98740E-09
10	3 85000E+06	.021	1.041	6.558	5.32975E-09
11	2.00000E+06	.019	1.061	6.77	9.33400E-09
12	1.00000E+06	.014	1.077	7.732	1.44780E-08
13	350000	9.00000E-03	1.089	8.674	2.51257E-08
14	350000	.011	1.099	8.823	3.18171E-08
15	300000	.015	1.112	9.846	5.60533E-08
16	200000	.012	1.125	10.081	5.89050E-08
17	100000	9.00000E-03	1.136	11.13	9.37900E-08
18	100000	.011	1.146	11.336	1.08950E-07
19	75000	.012	1.158	12.472	1.65240E-07
20	75000	.013	1.171	12.773	1.74680E-07

21	75000	.015	1.184	13.113	1.94280E-07
22	50000	.013	1.198	14.43	2.59539E-07
23	50000	.018	1.214	14.882	3.64660E-07
24	50000	.027	1.236	16.623	5.43780E-07
25	25000	.015	1.258	17.375	6.01518E-07
26	20000	.014	1.272	17.93	7.12502E-07
27	20000	.016	1.288	18.546	8.23349E-07
28	20000	.019	1.306	19.312	9.71401E-07
29	20000	.021	1.326	20.238	1.04510E-06
30	15000	.019	1.346	21.24	1.29414E-06
31	15000	.025	1.368	22.434	1.64446E-06
32	10000	.019	1.39	23.721	1.87310E-06
33	10000	.024	1.411	25.113	2.40580E-06



SPECIMEN NO : X60-14
*** SECANT METHOD ***
R = .5 @ 35 HZ
VACUUM
E-05
E-06
E-07
E-08
E-09
E-10
DA/DN INCH/CYCLE
E 00
E 01
E 02
DELTA-K - KSI*SQRT(INCH)

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SPECIMEN NO.: X60-14
DIMENSION (METER): B = .0127 W = .0508
2H = .05842 A(N) = .01778
R-RATIO = .5 @ 35 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6014 G.O NUMBER: 5230
7-JULY-1980

OBS. NO.	DELTA-N	CRACK LENGTH (MM)	P-MAX (NEWTONS)	DELTA-A (MM)
1	350000	4.555	8436	.725
2	500000	5.56	7992	1.005
3	1.00000E+06	6.451	6660	.891
4	1.02000E+06	6.976	5772	.525
5	2.00000E+06	7.771	5150.4	.796
6	1.00000E+06	7.984	4440	.212
7	2.00000E+06	8.132	3996	.148
8	5.00000E+06	8.153	3552	.021
9	5.00000E+06	8.405	3774	.252
10	3.85000E+06	8.926	3996	.521
11	2.00000E+06	9.401	3996	.474
12	1.00000E+06	9.768	4440	.368
13	350000	9.992	4884	.223
14	350000	10.275	4884	.283
15	300000	10.656	5328	.381
16	200000	10.955	5328	.299
17	100000	11.193	5772	.238
18	100000	11.47	5772	.277
19	75000	11.785	6216	.315
20	75000	12.118	6216	.333

21	75000	12.488	6216	.37
22	50000	12.817	6660	.33
23	50000	13.281	6660	.463
24	50000	13.971	7104	.691
25	25000	14.353	7104	.382
26	20000	14.715	7104	.362
27	20000	15.133	7104	.418
28	20000	15.627	7104	.493
29	20000	16.158	7104	.531
30	15000	16.651	7104	.493
31	15000	17.277	7104	.627
32	10000	17.753	7104	.476
33	10000	18.364	7104	611

*** SECANT METHOD ***

SPECIMEN NUMBER: X60-14
DIMENSION (METER): B = .0127 W = .0508
2H = .05842 A(N) = .01778

R-RATIO = .5 @ 35 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6014 G.O. NUMBER: 5230

OBS NUMBER	DELTA-N	DELTA-A (MM)	A (MM)	DELTA-K MPA*SQRT(METER)	DA/DN (MM/CYCLE)
1	350000	.725	21.972	11.7067	2.07235E-06
2	500000	1.005	22.838	11.6278	2.01056E-06
3	1.00000E+06	.891	23.786	10.22	8.90854E-07
4	1.02000E+06	.525	24.494	9.227	5.14449E-07
5	2.00000E+06	.796	25.154	8.5617	3.97764E-07
6	1.00000E+06	.212	25.658	7.60969	2.12394E-07
7	2.00000E+06	.148	25.838	6.92497	7.39901E-08
8	5.00000E+06	.021	25.922	6.18778	4.22668E-09
9	5.00000E+06	.252	26.059	6.63057	5.04799E-08
10	3.85000E+06	.521	26.446	7.19314	1.35366E-07
11	2.00000E+06	.474	26.944	7.42591	2.37084E-07
12	1.00000E+06	.368	27.365	8.48106	3.67741E-07
13	350000	.223	27.66	9.5141	6.38193E-07
14	350000	.283	27.913	9.6775	8.08157E-07
15	300000	.381	28.245	10.7992	1.27135E-06
16	200000	.299	28.586	11.0572	1.49619E-06
17	100000	.238	28.854	12.2074	2.38227E-06
18	100000	.277	29.112	12.4337	2.76732E-06
19	75000	.315	29.408	13.6798	4.19711E-06
20	75000	.333	29.731	14.0093	4.43686E-06

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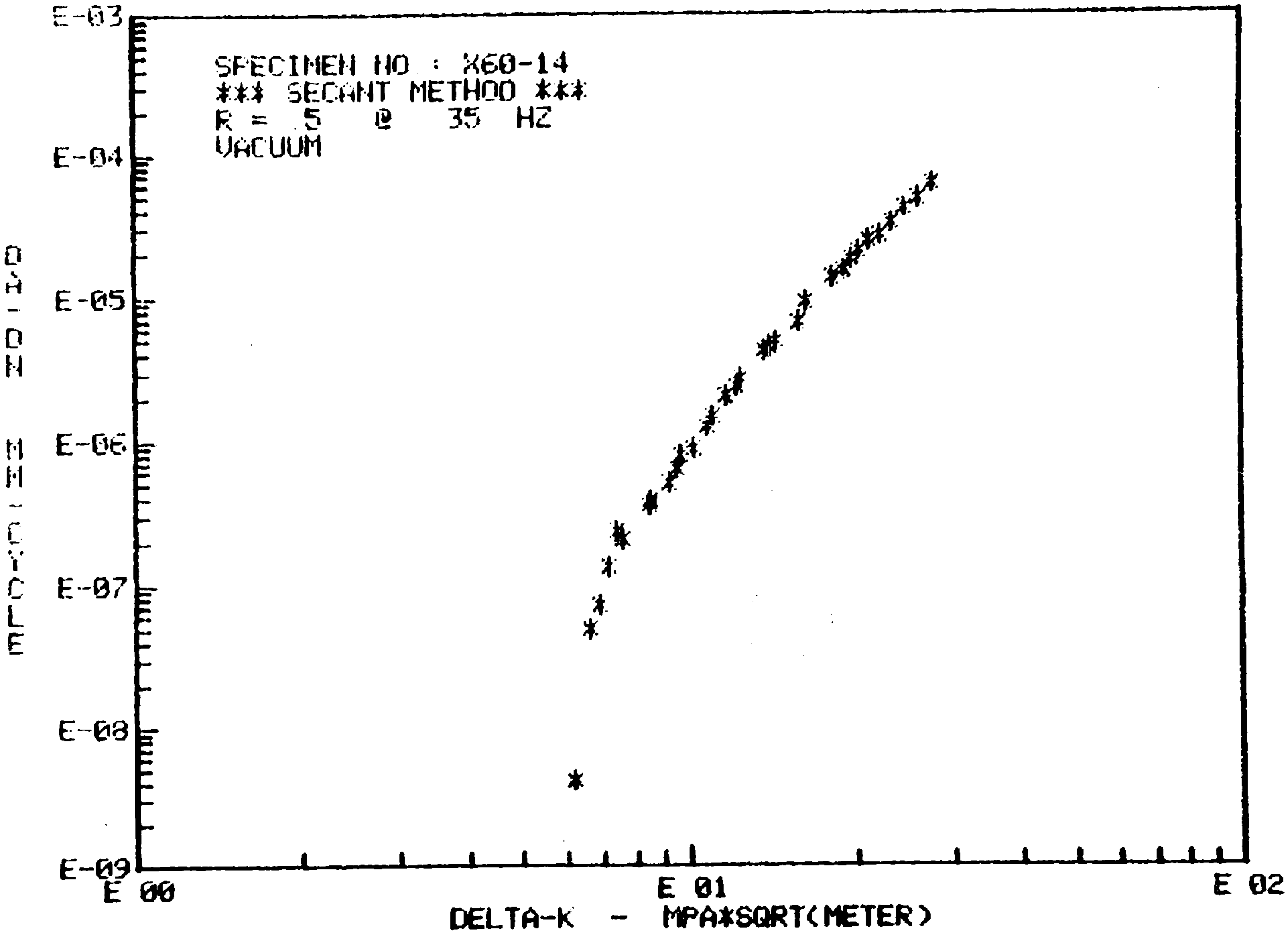
21	75000	.37	30.083	14.3827	4.93472E-06
22	50000	.33	30.433	15.8266	6.59229E-06
23	50000	.463	30.829	16.3224	9.26237E-06
24	50000	.691	31.406	18.2321	1.38120E-05
25	25000	.382	31.942	19.0566	1.52785E-05
26	20000	.362	32.314	19.6663	1.80975E-05
27	20000	.418	32.704	20.3419	2.09131E-05
28	20000	.493	33.16	21.1821	2.46736E-05
29	20000	.531	33.672	22.1976	2.65455E-05
30	15000	.493	34.184	23.2967	3.28710E-05
31	15000	.627	34.744	24.6055	4.17694E-05
32	10000	.476	35.295	26.0173	4.75767E-05
33	10000	.611	35.839	27.5448	6.11074E-05


SPECIMEN NO : X60-14
*** SECANT METHOD ***
R = .5 @ 35 HZ
VACUUM
E-03
E-04
E-05
E-06
E-07
E-08
E-09
E 00
E 01
E 02
DELTA-K - MPA*SQRT(METER)

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Vac; R = 0.8

SPECIMEN NO.: X6022
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .8 @ 30 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6022 G.O. NUMBER: 5230
4-DECEMBER-1980

OBS NO.	DELTA-N	CRACK LENGTH (INCH)	P-MAX (KIPS)	DELTA-A (INCH)
1	23000	.036	6	.036
2	850000	.066	5.5	.03
3	450000	.078	5.5	.013
4	200000	.091	5	.013
5	150000	.105	5	.013
6	150000	.118	5	.014
7	250000	.13	4.5	.012
8	300000	.143	4.5	.013
9	615000	.161	4.5	.018
10	300000	.177	4	.016
11	300000	.193	4	.016
12	300000	.207	4	.014
13	705000	.228	3.6	.021
14	400000	.251	3.6	.023
15	815000	.275	3.4	.025
16	310000	.297	3.4	.022
17	270000	.312	3.1	.014
18	730000	.333	3.1	.021
19	670000	.35	2.8	.017
20	250500	.36	2.8	.011

21	300000	.371	2.8	.011
22	1.02550E+06	.386	2.52	.014
23	325000	.397	2.52	.011
24	400000	.409	2.52	012
25	750500	.423	2.27	.013
26	355000	.435	2.27	.012
27	555000	.448	2.27	.013
28	855000	.461	2.045	013
29	300000	.472	2.045	.011
30	400000	.486	2 045	.014
31	2.83500E+06	.527	1 845	.041
32	1.50000E+06	.567	1.75	.04
33	490000	.588	1 65	.021
34	410000	.598	1.65	01
35	1.00000E+06	.622	1.5	.025
36	567000	.654	1.5	.032
37	310000	.666	1.35	.012
38	430000	682	1.35	.017
39	1.00000E+06	.703	1 2	.021
40	500000	.727	1.2	.024

41	1.80000E+06	.744	1	.017
42	1.69100E+06	765	.9	.021
43	6.00000E+06	.79	.8	.025
44	400000	.809	.9	.019
45	285000	.821	.9	.012
46	250000	.831	.9	.01
47	670000	.849	.9	.017
48	265000	.861	.9	.013
49	150000	.877	9	.015
50	150000	.891	.9	.015
51	150000	.904	.9	.013
52	125000	.919	.9	.015
53	115000	.934	9	.015
54	115000	.949	.9	.015
55	800	.987	9	.038

SC5230.17FR

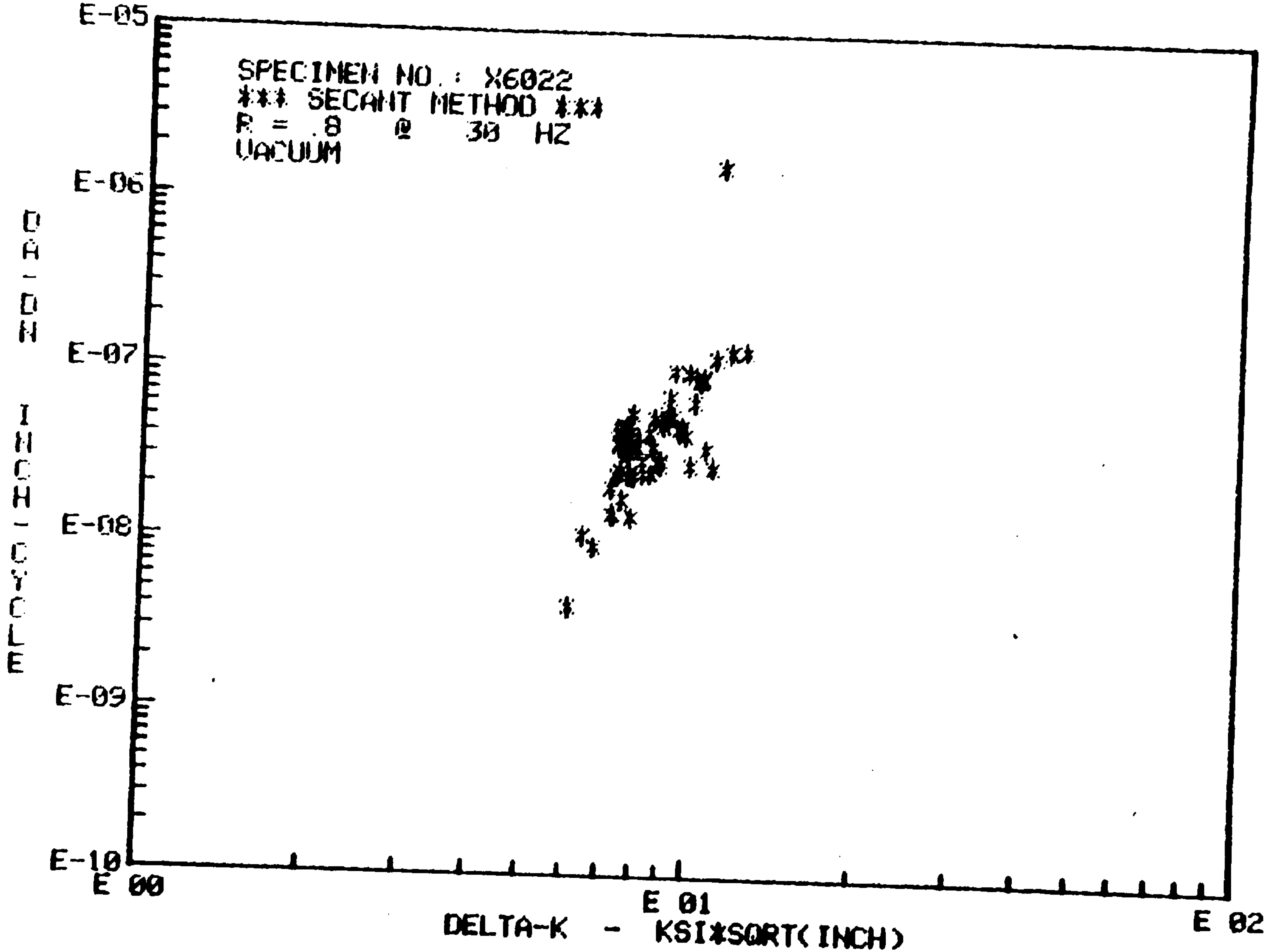
*** SECANT METHOD ***

SPECIMEN NUMBER: X6022
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = 8 @ 30 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6022 G.O. NUMBER: 5230

OBS NUMBER	DELTA-N	DELTA-A (INCH)	A (INCH)	DELTA-K KSI*SQRT(INCH)	DA/DN INCH/CYCLE
1	23000	.036	.718	11.095	1.56187E-08
2	850000	.03	.751	10.613	3.53561E-08
3	450000	.013	.772	10.912	2.78600E-08
4	200000	.013	.785	10.089	6.64855E-08
5	150000	.013	.798	10.206	8.72273E-08
6	150000	.014	.812	10.452	9.25800E-08
7	250000	.012	.824	9.571	4.01166E-08
8	300000	.013	.837	9.731	4.25467E-08
9	615000	.018	.852	9.934	2.87154E-08
10	300000	.016	.869	9.034	5.25834E-08
11	300000	.016	.885	9.238	5.46733E-08
12	300000	.014	.9	9.435	4.59500E-08
13	705000	.021	.917	8.702	2.95234E-08
14	400000	.023	.939	8.98	5.71200E-08
15	815000	.025	.963	8.783	3.04184E-08
16	310000	.022	.986	9.097	7.13322E-08
17	270000	.014	1.005	8.529	5.30116E-08
18	730000	.021	1.022	8.767	2.85768E-08
19	670000	.017	1.041	8.16	2.52850E-08
20	250500	.011	1.055	8.346	4.37485E-08

21	300000	.011	1.066	8.498	3.63100E-09
22	1.02550E+06	.014	1.079	7.811	1.40673E-09
23	325000	.011	1.092	7.984	3.52763E-08
24	400000	.012	1.103	8.147	3.02825E-08
25	750500	.013	1.116	7.504	1.79721E-08
26	355000	.012	1.129	7.675	3.37351E-08
27	555000	.013	1.141	7.851	2.39946E-08
28	855000	.013	1.154	7.242	1.46854E-09
29	300000	.011	1.166	7.403	3.70601E-08
30	400000	.014	1.179	7.58	3.46056E-08
31	2.83500E+06	.041	1.206	7.214	1.45503E-08
32	1.50000E+06	.04	1.247	7.429	2.64134E-08
33	490000	.021	1.277	7.476	4.31449E-08
34	410000	.01	1.293	7.74	2.49512E-08
35	1.06000E+06	.025	1.31	7.32	2.45630E-09
36	567000	.032	1.338	7.82	5.56031E-08
37	310000	.012	1.36	7.421	3.77451E-08
38	490000	.017	1.374	7.69	3.38706E-08
39	1.00000E+06	.021	1.393	7.175	2.08370E-08
40	500000	.024	1.415	7.618	4.75960E-08

41	1.80000E+06	.017	1.435	6.719	9.40889E-09
42	1.89100E+06	.021	1.454	6.383	1.09138E-08
43	6.00000E+06	.025	1.477	6.078	4.19799E-09
44	400000	.019	1.499	7.326	4.73350E-08
45	285000	.012	1.515	7.709	4.38245E-08
46	250000	.01	1.526	8.008	4.14240E-08
47	670000	.017	1.54	8.395	2.56090E-08
48	265000	.013	1.555	8.85	4.83169E-08
49	150000	.015	1.569	9.314	1.01333E-07
50	150000	.015	1.584	9.85	9.72398E-08
51	150000	.013	1.598	10.397	8.72266E-08
52	125000	.015	1.612	11	1.19000E-07
53	115000	015	1.627	11.708	1.30705E-07
54	115000	.015	1.642	12.5	1.32139E-07
55	800	.038	1.668	14.104	4.69028E-05


SPECIMEN NO.: X6022
*** SECANT METHOD ***
R = .8 @ 30 HZ
VACUUM
E-05
E-06
E-07
E-08
E-09
E-10
DA/DN INCH/CYCLE
E 00
E 01
E 02
DELTA-K - KSI*SQRT(INCH)

SPECIMEN NO.: X6022
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .8 @ 30 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6022 G.O. NUMBER: 5230
4-DECEMBER-1980

OBS. NO.	DELTA-N	CRACK LENGTH (MM)	P-MAX (NEWTONS)	DELTA-A (MM)
1	23000	.902	26640	.912
2	850000	1.665	24420	.763
3	450000	1.984	24420	.318
4	200000	2.322	22200	.338
5	150000	2.656	22200	.334
6	150000	3.009	22200	.353
7	250000	3.314	19980	.306
8	300000	3.638	19980	.324
9	615000	4.087	19980	.449
10	300000	4.487	17760	.401
11	300000	4.904	17760	.417
12	300000	5.254	17760	.35
13	705000	5.783	15984	.529
14	400000	6.363	15984	.58
15	815000	6.993	15096	.63
16	310000	7.555	15096	.562
17	270000	7.918	13764	.364
18	730000	8.448	13764	.53
19	670000	8.878	12432	.43
20	250500	9.157	12432	.278

21	300000	9.433	12432	.277
22	1.02550E+06	9.8	11188.8	.366
23	325000	10.091	11188.8	.291
24	400000	10.399	11188.8	.308
25	750500	10.741	10078.8	.342
26	355000	11.045	10078.8	.304
27	555000	11.383	10078.8	.338
28	855000	11.702	9079.8	.319
29	300000	11.984	9079.8	.282
30	400000	12.336	9079.8	.352
31	2.83500E+06	13.384	8191.8	1.048
32	1 50000E+06	14.39	7770	1.006
33	490000	14.927	7326	.537
34	410000	15.187	7326	.26
35	1.00000E+06	15.811	6660	.624
36	567000	16.612	6660	.801
37	310000	16.909	5994	.297
38	430000	17.33	5994	.421
39	1.00000E+06	17.86	5328	.529
40	500000	18.464	5328	.604

41	1.80000E+06	18.894	4440	.43
42	1.89100E+06	19.418	3996	.524
43	6.00000E+06	20.058	3552	.64
44	400000	20.539	3996	.481
45	285000	20.856	3996	.317
46	250000	21.119	3996	.263
47	670000	21.555	3996	436
48	265000	21.88	3996	.325
49	150000	22.266	3996	.386
50	150000	22.637	3996	.37
51	150000	22.972	3996	.335
52	125000	23.349	3996	.378
53	115000	23.731	3996	.382
54	115000	24.117	3996	.386
55	800	25.07	3996	.953

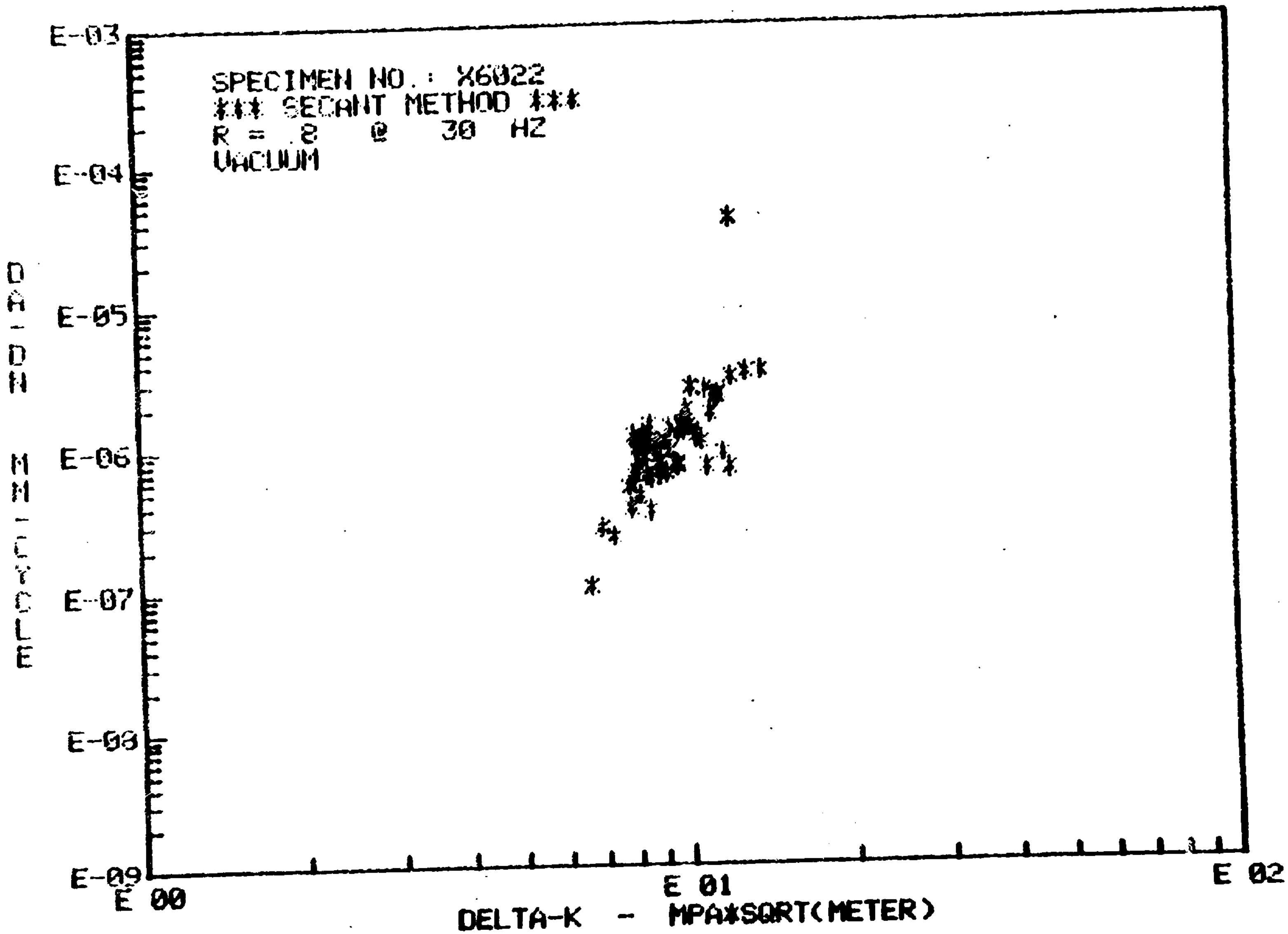
*** SECANT METHOD ***

SPECIMEN NUMBER: X6022
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .8 @ 30 HZ.
TEST ENVIRONMENT: VACUUM
DATA FILE : X6022 G.O. NUMBER: 5230

OBS. NUMBER	DELTA-N	DELTA-A (MM)	A (MM)	DELTA-K MPA*SQRT(METER)	DA/DN (MM/CYCLE)
1	23000	.912	18.226	12.1691	3.96714E-05
2	850000	.763	19.064	11.6407	8.98045E-07
3	450000	.318	19.605	11.968	7.07644E-07
4	200000	.338	19.933	11.0656	1.68873E-06
5	150000	.334	20.269	11.2601	2.22822E-06
6	150000	.353	20.612	11.4637	2.35153E-06
7	250000	.306	20.941	10.4972	1.22215E-06
8	300000	.324	21.256	10.6735	1.08069E-06
9	615000	.449	21.643	10.8956	7.29372E-07
10	300000	.401	22.067	9.90699	1.33562E-06
11	300000	.417	22.476	10.1319	1.38870E-06
12	300000	.35	22.859	10.3481	1.16713E-06
13	705000	.529	23.299	9.54434	7.49894E-07
14	400000	.58	23.853	9.84699	1.45085E-06
15	815000	.63	24.458	9.6329	7.72628E-07
16	310000	.562	25.054	9.97802	1.81184E-06
17	270000	.364	25.516	9.35502	1.34648E-06
18	730000	.53	25.963	9.6153	7.25850E-07
19	670000	.43	26.443	8.94993	6.42240E-07
20	250500	.278	26.798	9.1545	1.11121E-06

21	300000	.277	27.075	9.32032	9.22273E-07
22	1.02550E+06	.366	27.397	8.56703	3.57309E-07
23	325000	.291	27.725	8.75662	8.96034E-07
24	400000	.308	28.025	8.93557	7.69174E-07
25	750500	.342	28.35	8.23039	4.55475E-07
26	355000	.304	28.673	8.41774	8.56872E-07
27	555000	.338	28.994	8.6114	6.09463E-07
28	855000	.319	29.322	7.94352	3.73008E-07
29	300000	.282	29.623	8.12017	9.41327E-07
30	400000	.352	29.94	8.31381	8.78966E-07
31	2.83500E+06	1.048	30.64	7.91253	3.69576E-07
32	1.50000E+06	1.006	31.667	8.14867	6.70900E-07
33	490000	.537	32.438	8.19945	1.09588E-06
34	410000	.26	32.837	8.48944	6.33763E-07
35	1.00000E+06	.624	33.279	8.02905	6.24407E-07
36	567000	.801	33.992	8.57723	1.41232E-06
37	310000	.297	34.541	8.13912	9.58726E-07
38	490000	.421	34.9	8.4345	8.59299E-07
39	1.00000E+06	.529	35.375	7.8697	5.29261E-07
40	500000	.604	35.942	8.35533	1.20894E-06

41	1.80000E+06	.43	36.459	7.3691	2.38985E-07
42	1.89100E+06	.524	36.936	7.00146	2.77211E-07
43	6.00000E+06	.64	37.518	6.66592	1.06629E-07
44	400000	.481	38.079	8.03492	1.20231E-06
45	235000	.317	38.478	8.45533	1.11314E-06
46	250000	.263	38.768	8.78374	1.05217E-06
47	670000	.436	39.117	9.20738	6.50468E-07
48	265000	.325	39.498	9.70734	1.22725E-06
49	150000	.385	39.853	10.2153	2.57387E-06
50	150000	.37	40.232	10.8041	2.46990E-06
51	150000	.335	40.584	11.4035	2.23080E-06
52	125000	.378	40.94	12.0651	3.02260E-06
53	115000	.382	41.32	12.841	3.31390E-06
54	115000	.386	41.704	13.7098	3.35632E-06
55	800	.953	42.374	15.4697	1.19148E-03


SPECIMEN NO.: X6022
*** SECANT METHOD ***
R = .8 @ 30 HZ
VACUUM
E-03
E-04
E-05
E-06
E-07
E-08
E-09
DA-DN MM-CYCLE
E 00
E 01
E 02
DELTA-K - MPA*SQRT(METER)

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Air; R = 0.1

SPECIMEN NO.: X60-005
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .1 @ 20 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60005 G.O. NUMBER: 5232
20-JAN-80

OBS. NO.	DELTA-N	CRACK LENGTH (INCH)	P-MAX (KIPS)	DELTA-A (INCH)
1	2.62564E+06	.217	.721375	.031
2	4.78035E+06	.25	.651206	.033
3	1.08263E+07	.272	.577915	.022
4	686763	.293	.685748	.02
5	483188	.313	.688528	.02
6	397479	.333	.693272	.02
7	292732	.353	.698202	.02
8	300380	.382	.704111	.029
9	145574	.403	.702515	.021
10	127702	.423	.681001	.02
11	207809	.466	.665663	.042
12	170362	.507	.672452	.042
13	120829	.548	.668343	.041
14	89057	.59	.650897	.042
15	57356	.63	.633151	.04
16	31838	.672	.648422	.042
17	27453	.712	.604898	.04
18	16225	.755	.608444	.043
19	7424	.788	.616746	.032
20	4221	.823	.637387	.035

21	2955	.856	.653753	.034

SPECIMEN NUMBER: X60-005
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .1 @ 20 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60005 G.O. NUMBER: 5232

OBS. NUMBER	DELTA-N	DELTA-A (INCH)	A (INCH)	DELTA-K KSI*SQRT(INCH)	DA/DN INCH/CYCLE
1	2.62564E+06	.031	.902	7.675	1.19220E-08
2	4.78035E+06	.033	.934	7.252	6.84615E-09
3	1.08283E+07	.022	.961	6.7	2.04557E-09
4	686763	.02	.982	8.207	2.96944E-08
5	483188	.02	1.003	8.5	4.19175E-08
6	397479	.02	1.023	8.833	5.08026E-08
7	292732	.02	1.043	9.185	6.84756E-08
8	300380	.029	1.068	9.644	9.72767E-08
9	145574	.021	1.093	10.038	1.45369E-07
10	127702	.02	1.113	10.082	1.56200E-07
11	207809	.042	1.144	10.417	2.03105E-07
12	170362	.042	1.186	11.382	2.44433E-07
13	120829	.041	1.228	12.275	3.37973E-07
14	89057	.042	1.269	13.043	4.73270E-07
15	57356	.04	1.31	13.908	7.00171E-07
16	31838	.042	1.351	15.701	1.31038E-06
17	27453	.04	1.392	16.25	1.45751E-06
18	16225	.043	1.434	18.31	2.66700E-06
19	7424	.032	1.472	20.733	4.36019E-06
20	4221	.035	1.505	23.802	8.24875E-06

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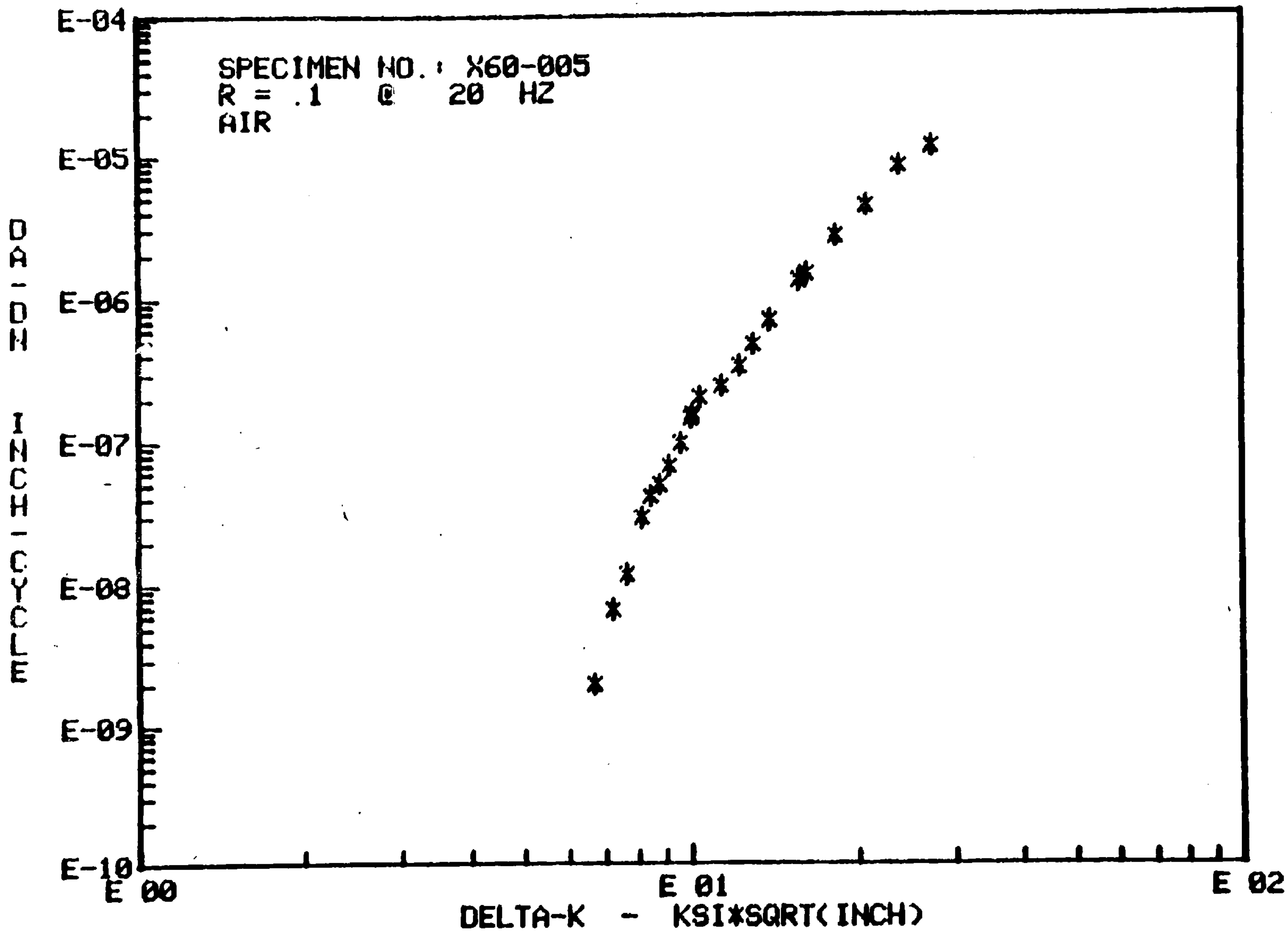
21	2955	.034	1.539	27.385	1.14315E-05


SPECIMEN NO.: X60-005
R = .1 @ 20 HZ
AIR
DA/DN INCH/CYCLE
E-04
E-05
E-06
E-07
E-08
E-09
E-10
E 00
E 01
E 02
DELTA-K - KSI*SQRT(INCH)

SPECIMEN NO.: X60-005
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .1 @ 20 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60005 G.O. NUMBER: 5232
20-JAN-80

OBS. NO.	DELTA-N	CRACK LENGTH (MM)	P-MAX (NEWTONS)	DELTA-A (MM)
1	2.62564E+06	5.519	3202.91	.795
2	4.78035E+06	6.351	2891.35	.831
3	1.08283E+07	6.913	2565.94	.563
4	686763	7.431	3044.72	.518
5	483188	7.946	3057.06	.514
6	397479	8.459	3078.13	.513
7	292732	8.968	3100.02	.509
8	300380	9.71	3126.25	.742
9	145574	10.248	3119.17	.538
10	127702	10.754	3023.64	.507
11	207809	11.826	2955.54	1.072
12	170362	12.884	2985.69	1.058
13	120829	13.921	2967.44	1.037
14	89057	14.992	2889.98	1.071
15	57356	16.012	2811.19	1.02
16	31838	17.072	2878.99	1.06
17	27453	18.088	2685.75	1.016
18	16225	19.187	2701.49	1.099
19	7424	20.009	2738.35	.822
20	4221	20.894	2830	.884

21	2955	21.752	2902.66	.858

SPECIMEN NUMBER: X60-005
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .1 @ 20 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60005 G.O. NUMBER: 5232

OBS. NUMBER	DELTA-N	DELTA-A (MM)	A (MM)	DELTA-K MPA*SQRT(METER)	DA/DN (MM/CYCLE)
1	2.62564E+06	.795	22.902	8.41792	3.02820E-07
2	4.78035E+06	.831	23.715	7.95429	1.73892E-07
3	1.08283E+07	.563	24.412	7.3483	5.19574E-08
4	686763	.518	24.952	9.0015	7.54237E-07
5	483188	.514	25.469	9.32296	1.06470E-06
6	397479	.513	25.982	9.68798	1.29039E-06
7	292732	.509	26.493	10.0747	1.73928E-06
8	300380	.742	27.119	10.5772	2.47083E-06
9	145574	.538	27.759	11.0097	3.69238E-06
10	127702	.507	28.281	11.0585	3.96748E-06
11	207809	1.072	29.07	11.4258	5.15886E-06
12	170362	1.058	30.135	12.4843	6.20858E-06
13	120829	1.037	31.183	13.4636	8.58453E-06
14	89057	1.071	32.237	14.3057	1.20210E-05
15	57356	1.02	33.282	15.2547	1.77843E-05
16	31838	1.06	34.322	17.2207	3.32838E-05
17	27453	1.016	35.36	17.8233	3.70207E-05
18	16225	1.099	36.417	20.0831	6.77416E-05
19	7424	.822	37.378	22.7398	1.10749E-04
20	4221	.884	38.231	26.1066	2.09519E-04

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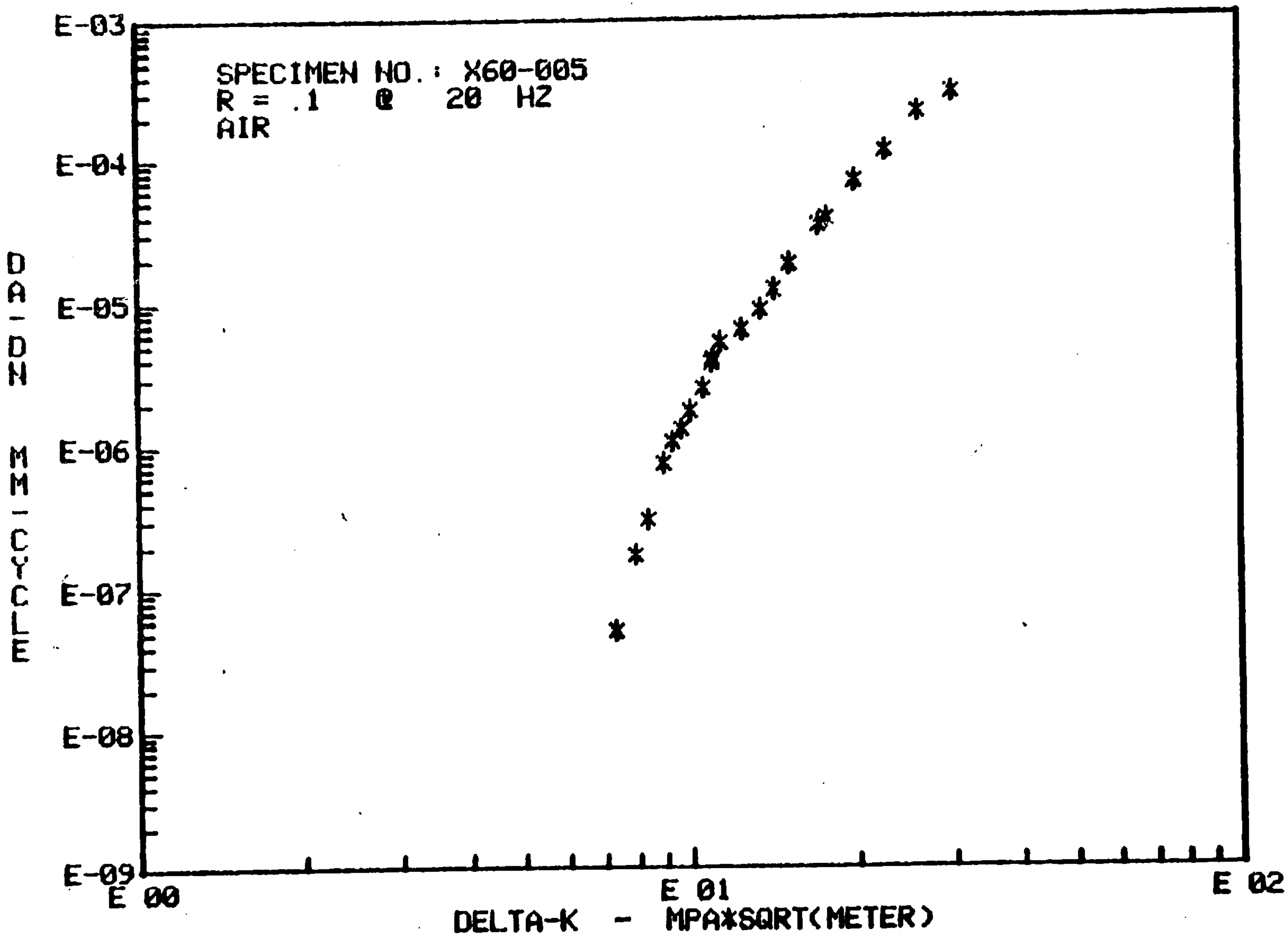
21	2955	.858	39.103	30.0363	2.90359E-04


SPECIMEN NO.: X60-005
R = .1 @ 20 HZ
AIR
DA-DN MM-CYCLE
E-03
E-04
E-05
E-06
E-07
E-08
E-09
E 00
E 01
E 02
DELTA-K - MPA*SQRT(METER)

SC5230.17FR

SPECIMEN NO. : X60-006
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .8 @ 30 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60006 G.O. NUMBER: 5232
26-JAN-80

OBS. NO.	DELTA-N	CRACK LENGTH (INCH)	P-MAX (KIPS)	DELTA-A (INCH)
1	304532	.24	2.24306	.046
2	312014	.276	2.00317	.036
3	408764	.313	1.75678	.037
4	572658	.352	1.4986	.038
5	695190	.386	1.26879	.035
6	974400	.423	1.0686	.036
7	2.34265E+06	.452	.851771	.029
8	1.17550E+06	.464	.739267	.013
9	3.15967E+06	.483	.664241	.019
10	1.00000E+07	.493	.580776	.01
11	81791	.503	1.46646	.01
12	106524	.522	1.56737	.02
13	103252	.544	1.64918	.022
14	56715	.562	1.81078	.018
15	37948	.579	1.86868	.017
16	30405	.597	1.9824	.018

Air; R = 0.5

SPECIMEN NO.: X60-004
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .5 @ 30 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60004 G.O. NUMBER: 5232
6-JAN-80

OBS. NO.	DELTA-N	CRACK LENGTH (INCH)	P-MAX (KIPS)	DELTA-A (INCH)
1	222706	.207	.903734	.02
2	188930	.228	.903908	.02
3	316694	.248	.781342	.021
4	273143	.268	.784195	.02
5	446405	.289	.673235	.021
6	378322	.309	.675088	.02
7	580359	.33	.579425	.021
8	535650	.349	.57884	.02
9	869591	.37	.479059	.021
10	737598	.39	.479272	.02
11	1.40224E+06	.411	.387721	.021
12	1.33359E+06	.431	.386808	.02
13	4.60064E+06	.455	.31717	.024
14	3.66291E+06	.478	.306667	.023
15	6.72723E+06	.502	.288409	.024
16	2.37521E+06	.525	.293692	.023
17	2.33132E+06	.548	.290772	.023
18	1.81132E+06	.57	.289104	.022
19	276729	.587	.435459	.017
20	192164	.608	.507267	.021

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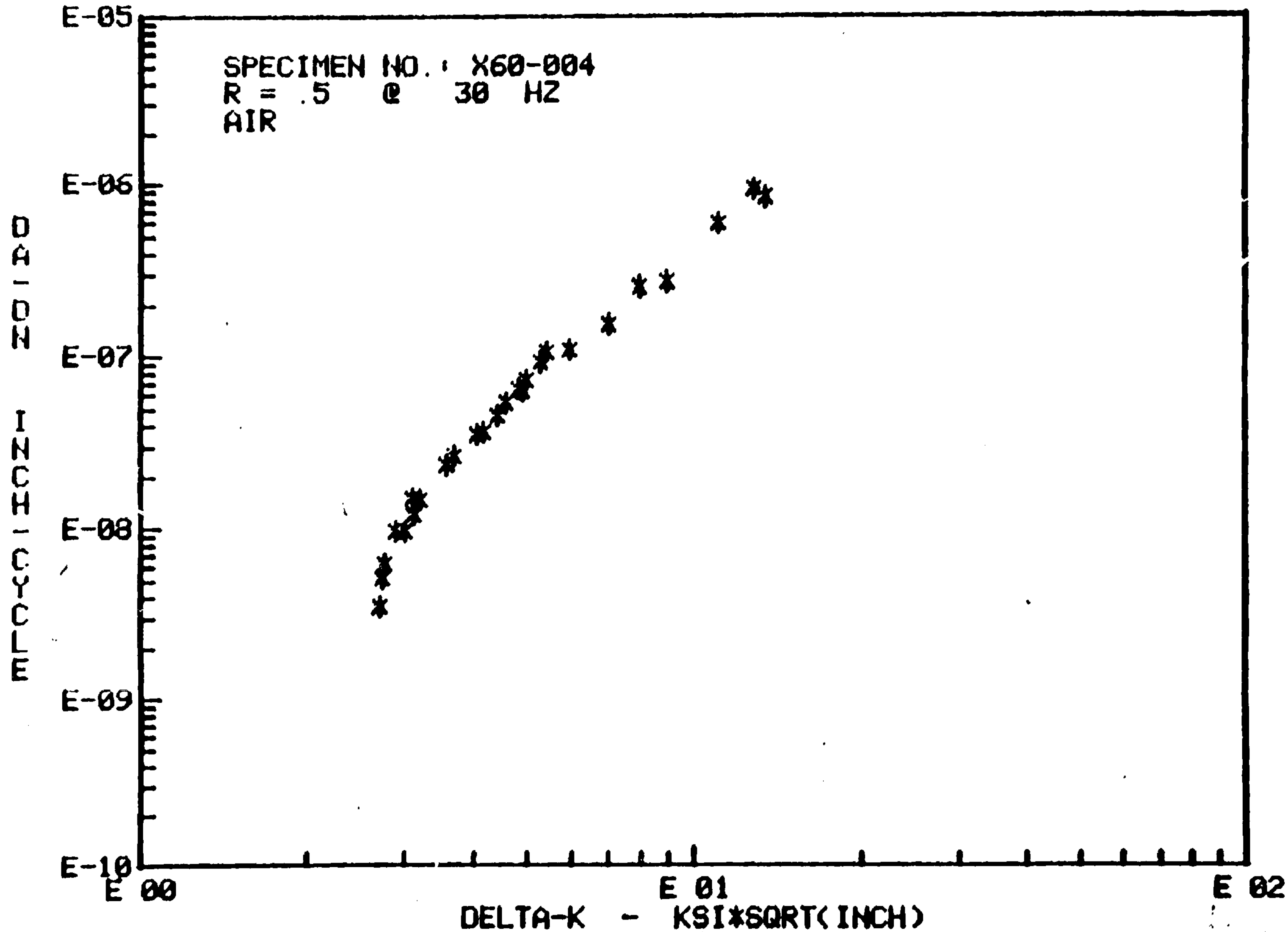
21	133092	.629	.566512	.021
22	77059	.648	.615275	.02
23	69209	.667	.657797	.019
24	36373	.689	.773509	.022
25	19580	.707	.851569	.018
26	21948	.725	.850032	.018

SPECIMEN NUMBER: X60-004
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .5 @ 30 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60004 G.O. NUMBER: 5232

OBS. NUMBER	DELTA-N	DELTA-A (INCH)	A (INCH)	DELTA-K KSI*SQRT(INCH)	DA/DN INCH/CYCLE
1	222706	.02	.897	5.309	9.20047E-08
2	188930	.02	.918	5.464	1.06362E-07
3	316694	.021	.938	4.864	6.49018E-08
4	273143	.02	.958	5.029	7.33242E-08
5	446405	.021	.978	4.45	4.59336E-08
6	378322	.02	.999	4.603	5.38748E-08
7	580359	.021	1.019	4.079	3.55849E-08
8	535650	.02	1.04	4.207	3.68953E-08
9	869591	.021	1.06	3.598	2.37457E-08
10	737598	.02	1.08	3.723	2.68832E-08
11	1.40224E+06	.021	1.101	3.119	1.51230E-08
12	1.33359E+06	.02	1.121	3.225	1.48426E-08
13	4.60064E+06	.024	1.143	2.75	5.20232E-09
14	3.66291E+06	.023	1.166	2.777	6.33977E-09
15	6.72723E+06	.024	1.19	2.731	3.54588E-09
16	2.37521E+06	.023	1.213	2.912	9.69053E-09
17	2.33132E+06	.023	1.236	3.021	9.81030E-09
18	1.81132E+06	.022	1.259	3.148	1.22104E-08
19	276729	.017	1.279	4.949	6.25882E-08
20	192164	.021	1.298	6.016	1.09402E-07

21	133092	.021	1.319	7.047	1.54292E-07
22	77059	.02	1.339	8.026	2.53105E-07
23	69209	.019	1.358	8.993	2.72927E-07
24	36373	.022	1.378	11.128	5.91399E-07
25	19580	.018	1.398	12.901	9.22371E-07
26	21948	.019	1.416	13.526	8.37251E-07


SPECIMEN NO.: X60-004
R = .5 @ 30 HZ
AIR
E-05
E-06
E-07
E-08
E-09
E-10
DA/DN INCH/CYCLE
E 00
E 01
E 02
DELTA-K - KSI*SQRT(INCH)

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SPECIMEN NO.: X60-004
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .5 @ 30 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60004 G.O. NUMBER: 5232
6-JAN-80

OBS. NO.	DELTA-N	CRACK LENGTH (MM)	P-MAX (NEWTONS)	DELTA-A (MM)
1	222706	5.27	4012.58	.52
2	188930	5.781	4013.35	.51
3	316694	6.303	3469.16	.522
4	273143	6.811	3481.83	.509
5	446405	7.332	2989.16	.521
6	378322	7.85	2997.39	.518
7	580359	8.375	2572.65	.525
8	535650	8.877	2570.05	.502
9	869591	9.401	2127.02	.524
10	737598	9.905	2127.97	.504
11	1.40224E+06	10.443	1721.48	.539
12	1.33359E+06	10.946	1717.43	.503
13	4.60064E+06	11.554	1408.23	.608
14	3.66291E+06	12.144	1361.6	.59
15	6.72723E+06	12.75	1280.54	.606
16	2.37521E+06	13.334	1303.99	.585
17	2.33132E+06	13.915	1291.03	.581
18	1.81132E+06	14.477	1283.62	.562
19	276729	14.917	1933.44	.44
20	192164	15.451	2252.27	.534

21	133092	15.973	2515.31	.522
22	77059	16.468	2731.82	.495
23	69209	16.948	2920.62	.48
24	36373	17.494	3434.38	.546
25	19580	17.953	3780.97	.459
26	21948	18.42	3774.14	.467

SPECIMEN NUMBER: X60-004
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .5 @ 30 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60004 G.O. NUMBER: 5232

OBS. NUMBER	DELTA-N	DELTA-A (MM)	A (MM)	DELTA-K MPA*SQRT(METER)	DA/DN (MM/CYCLE)
1	222706	.52	22.79	5.82265	2.33692E-06
2	188930	.51	23.305	5.99342	2.70160E-06
3	316694	.522	23.822	5.33447	1.64851E-06
4	273143	.509	24.337	5.51541	1.86243E-06
5	446405	.521	24.852	4.88035	1.16671E-06
6	378322	.518	25.371	5.0484	1.36842E-06
7	580359	.525	25.892	4.47335	9.03855E-07
8	535650	.502	26.406	4.61451	9.37141E-07
9	869591	.524	26.919	3.94638	6.03141E-07
10	737598	.504	27.433	4.08312	6.82832E-07
11	1.40224E+06	.539	27.954	3.4205	3.84123E-07
12	1.33359E+06	.503	28.475	3.53669	3.77002E-07
13	4.60064E+06	.608	29.03	3.0158	1.32139E-07
14	3.66291E+06	.59	29.629	3.04555	1.61030E-07
15	6.72723E+06	.606	30.227	2.99544	9.00655E-08
16	2.37521E+06	.585	30.822	3.19407	2.46139E-07
17	2.33132E+06	.581	31.405	3.31307	2.49182E-07
18	1.81132E+06	.562	31.976	3.45317	3.10145E-07
19	276729	.44	32.477	5.42791	1.58974E-06
20	192164	.534	32.964	6.59876	2.77880E-06

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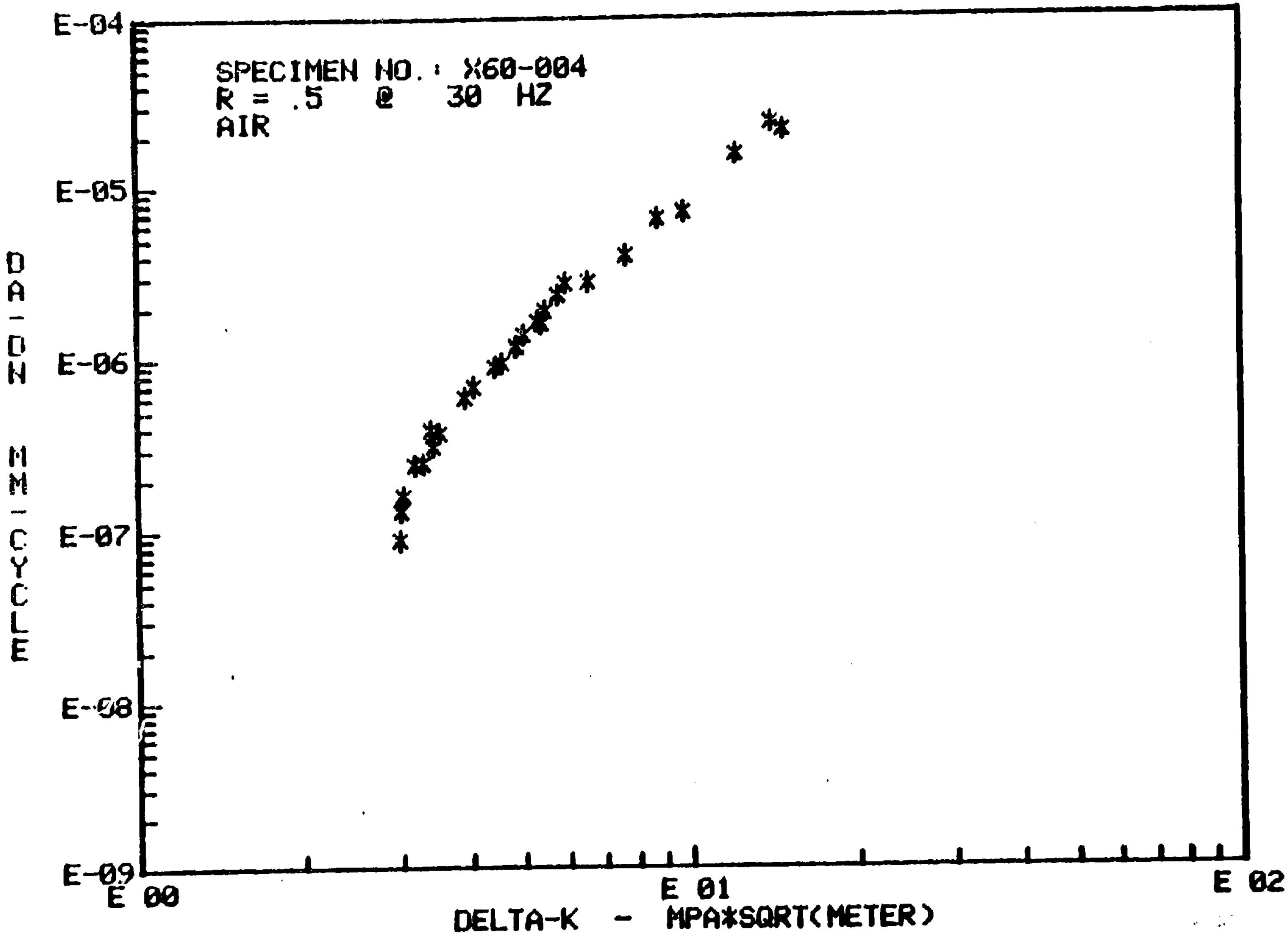
21	135092	.522	33.492	7.72954	3.91901E-06
22	77059	.495	34	8.80281	6.42887E-06
23	69209	.48	34.488	9.86351	6.93234E-06
24	36373	.546	35.001	12.2056	1.50216E-05
25	19580	.459	35.503	14.1498	2.34281E-05
26	21948	.467	35.966	14.8355	2.12662E-05


SPECIMEN NO.: X60-004
R = .5 @ 30 HZ
AIR
E-04
E-05
E-06
E-07
E-08
E-09
DA-DN MM-CYCLE
E 00
E 01
E 02
DELTA-K - MPA*SQRT(METER)

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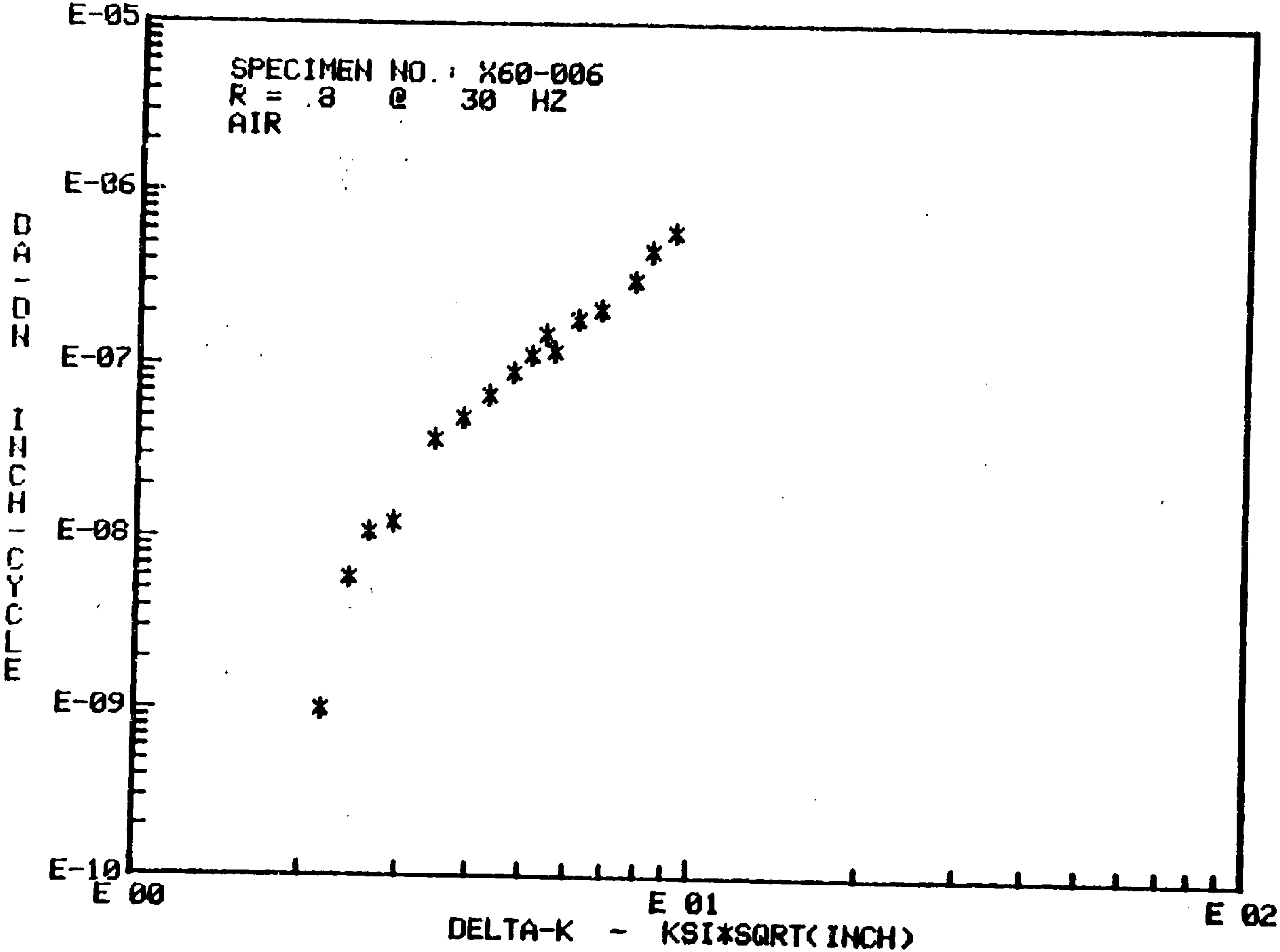
Air; R = 0.8


SPECIMEN NO.: X60-006
R = .8 @ 30 HZ
AIR
DA-DN INCH-CYCLE
E-05
E-06
E-07
E-08
E-09
E-10
E 00
E 01
E 02
DELTA-K - KSI*SQRT(INCH)

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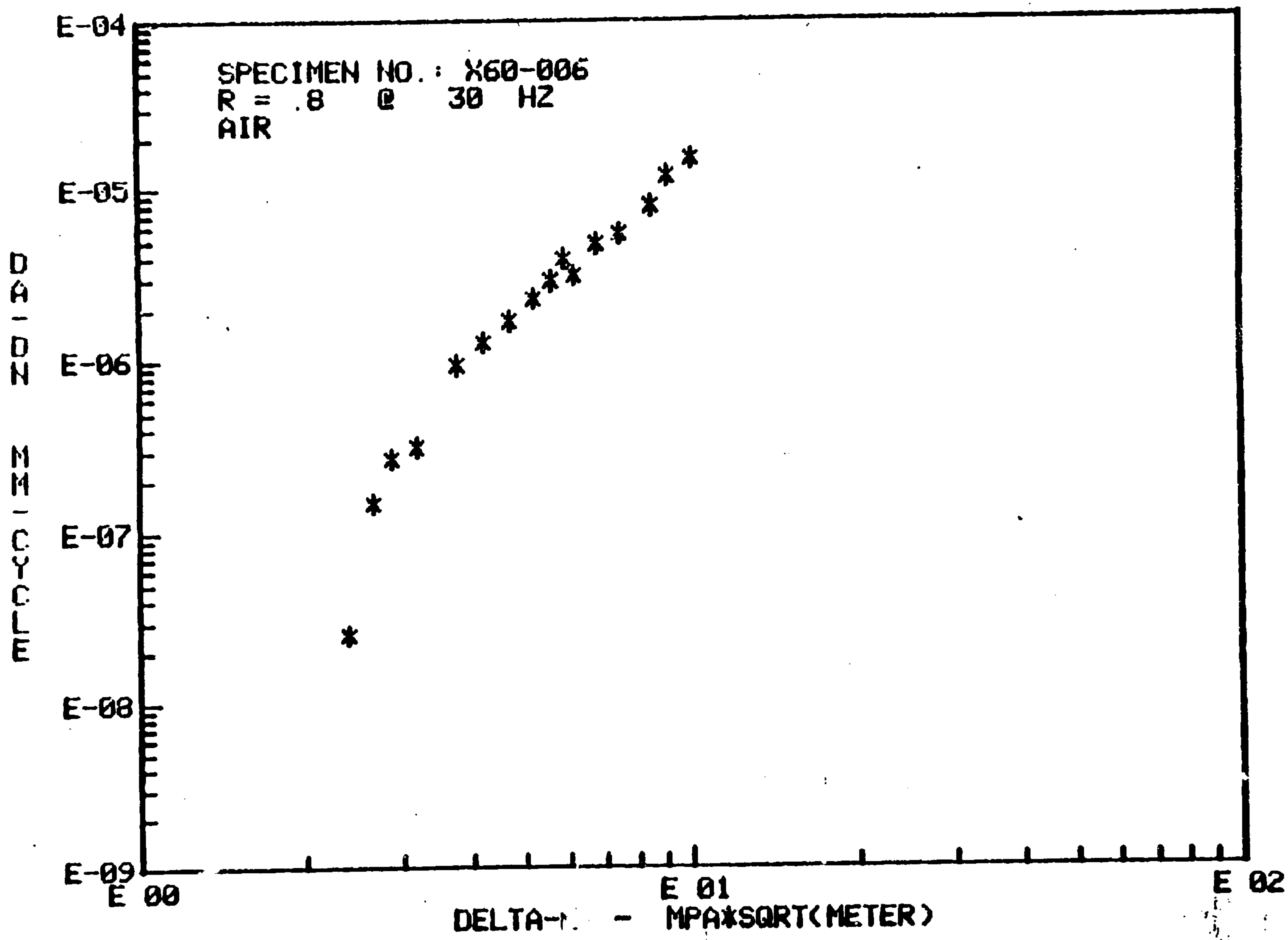
SPECIMEN NO.: X60-006
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .8 @ 30 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60006 G.O. NUMBER: 5232
26-JAN-80

OBS. NO.	DELTA-N	CRACK LENGTH (MM)	P-MAX (NEWTONS)	DELTA-A (MM)
1	304532	6.099	9959.19	1.172
2	312014	7.012	8894.07	.913
3	408764	7.958	7800.1	.946
4	572658	8.931	6653.78	.973
5	695190	9.812	5633.43	.88
6	974400	10.733	4745.47	.922
7	2.34265E+06	11.47	3781.86	.737
8	1.17550E+06	11.791	3282.35	.321
9	3.15967E+06	12.261	2949.23	.47
10	1.00000E+07	12.515	2578.65	.254
11	81791	12.769	6511.08	.253
12	106524	13.27	6959.12	.501
13	103252	13.826	7322.36	.556
14	56715	14.272	8039.86	.447
15	37948	14.714	8296.94	.441
16	30405	15.168	8801.86	.454

SPECIMEN NUMBER: X60-006
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .8 @ 30 HZ.
TEST ENVIRONMENT: AIR
DATA FILE : X60006 G.O. NUMBER: 5232

OBS. NUMBER	DELTA-N	DELTA-A (MM)	A (MM)	DELTA-K MPA*SQRT(METER)	DA/DN (MM/CYCLE)
1	304532	1.172	23.293	5.94507	3.84705E-06
2	312014	.913	24.336	5.63501	2.92600E-06
3	408764	.946	25.265	5.22148	2.31491E-06
4	572658	.973	26.225	4.72471	1.69914E-06
5	695190	.88	27.152	4.24452	1.26625E-06
6	974400	.922	28.052	3.79695	9.45852E-07
7	2.34265E+06	.737	28.882	3.20556	3.14528E-07
8	1.17550E+06	.321	29.411	2.89005	2.72928E-07
9	3.15967E+06	.47	29.806	2.67355	1.48887E-07
10	1.00000E+07	.254	30.168	2.40212	2.54001E-08
11	81791	.253	30.422	6.18405	3.09709E-06
12	106524	.501	30.799	6.80627	4.70522E-06
13	103252	.556	31.328	7.46955	5.38174E-06
14	56715	.447	31.829	8.54564	7.87370E-06
15	37948	.441	32.273	9.15518	1.16337E-05
16	30405	.454	32.721	10.0961	1.49451E-05


SPECIMEN NO.: X60-006
R = .8 @ 30 HZ
AIR
E-04
E-05
E-06
E-07
E-08
E-09
DA/DN MM/CYCLE
E 00
E 01
E 02
DELTA-K - MPA*SQRT(METER)

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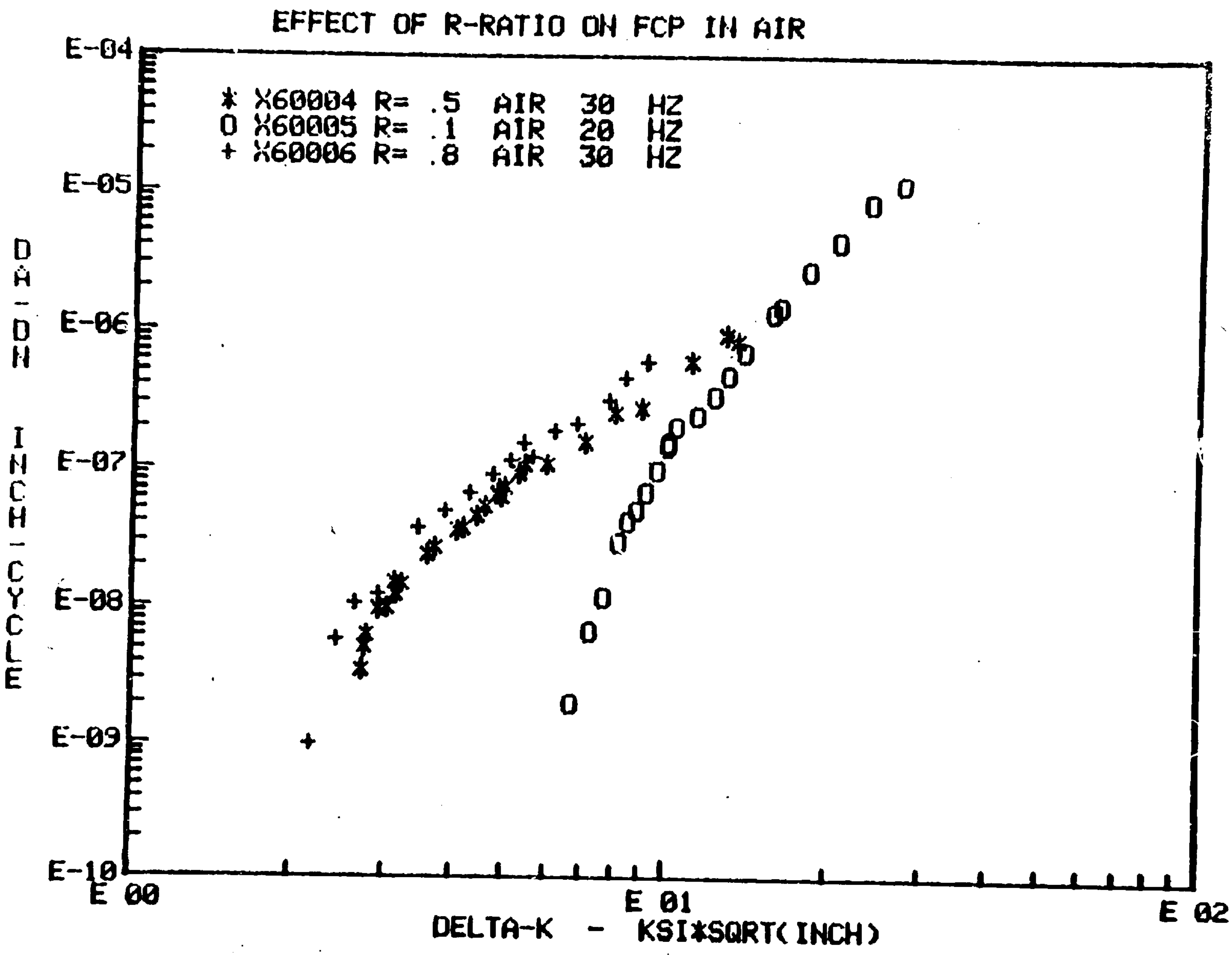
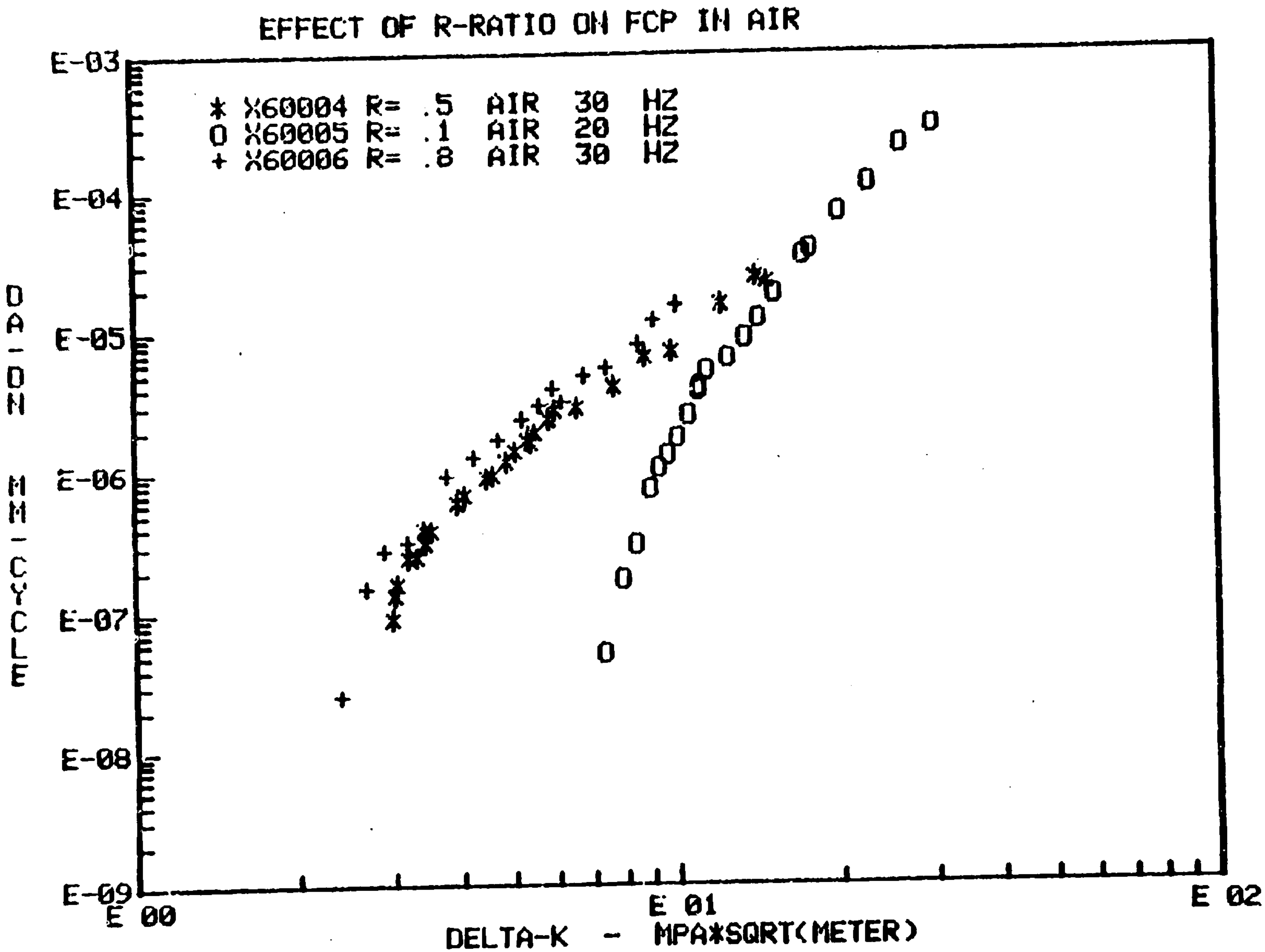

EFFECT OF R-RATIO ON FCP IN AIR
* X60004 R= .5 AIR 30 HZ
O X60005 R= .1 AIR 20 HZ
+ X60006 R= .8 AIR 30 HZ
DA-DN INCH-CYCLE
E-04
E-05
E-06
E-07
E-08
E-09
E-10
E 00
E 01
E 02
DELTA-K - KSI*SQRT(INCH)


EFFECT OF R-RATIO ON FCP IN AIR
* X60004 R= .5 AIR 30 HZ
O X60005 R= .1 AIR 20 HZ
+ X60006 R= .8 AIR 30 HZ
DA-DN MM-CYCLE
E-03
E-04
E-05
E-06
E-07
E-08
E-09
E 00
E 01
E 02
DELTA-K - MPA*SQRT(METER)

SC5230.17FR

H_2; R = 0.1

C-2

SPECIMEN NO.: X60-24
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .1 @ 30 HZ.
TEST ENVIRONMENT: GH2
DATA FILE : X6024 G.O. NUMBER: 5230
2-23-81

OBS. NO.	DELTA-N	CRACK LENGTH (INCH)	P-MAX (KIPS)	DELTA-A (INCH)
1	120000	.022	1.5	.022
2	257700	.042	1.3	.02
3	590000	.06	1.15	.018
4	750000	.086	1.05	.026
5	1.55000E+06	.119	.95	.033
6	630000	.141	.85	.022
7	600000	.165	.75	.024
8	1.00000E+06	.195	.625	.03
9	652000	.218	.625	.023
10	1.03000E+06	.254	.55	.035
11	2.00000E+06	.283	.5	.029
12	2.68000E+06	.31	.45	.027
13	2.30000E+06	.342	.425	.033
14	1.92000E+06	.367	.4	.025
15	2.25000E+06	.389	.375	.022
16	3.96000E+06	.409	.35	.02
17	2.66000E+06	.432	.35	.023
18	2.50000E+06	.461	.33	.029
19	4.02700E+06	.482	.31	.02
20	3.03000E+06	.503	.31	.021

21	2.50000E+06	.527	.3	.025
22	830000	.548	.29	.021
23	500000	.568	.29	.021
24	850000	.589	.29	.02
25	700000	.611	.29	.023
26	270000	.633	.29	.022
27	300000	.657	.29	.024
28	350000	682	.29	.025
29	250000	.715	.29	.033
30	150000	.739	.29	.024
31	100000	.769	.29	.03
32	50000	.79	.29	.021
33	60000	.813	.29	.023
34	25000	.835	.29	.022
35	20000	.855	.29	.02
36	20000	877	.29	.022

*** SECANT METHOD ***

SPECIMEN NUMBER: X60-24
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .1 @ 30 HZ.
TEST ENVIRONMENT: GH2
DATA FILE : X6024 G.O. NUMBER: 5230

OBS. NUMBER	DELTA-N	DELTA-A (INCH)	A (INCH)	DELTA-K KSI*SQRT(INCH)	DA/DN INCH/CYCLE
1	120000	022	.711	12.374	1.83333E-07
2	257700	.02	.732	11.015	7.72216E-08
3	590000	018	.751	9.987	3.08475E-08
4	750000	.026	.773	9.385	3.46667E-08
5	1.55000E+06	.033	.862	8.828	2.14194E-08
6	630000	022	.83	8.196	3.52381E-08
7	800000	024	.853	7.463	3.05000E-08
8	1.00000E+06	.03	.88	6.454	2.90000E-08
9	652000	.023	.907	6.698	3.52896E-08
10	1.03000E+06	.035	.936	6.148	3.44660E-08
11	2.00000E+06	.029	.968	5.859	1.43000E-08
12	2.68000E+06	.027	.996	5.5	1.01492E-08
13	2.30000E+06	.033	1.026	5.443	1.42174E-08
14	1.92000E+06	.025	1.055	5.365	1.29688E-08
15	2.25000E+06	.022	1.078	5.227	9.60000E-09
16	3.98000E+06	.02	1.099	5.054	5.02512E-09
17	2.66000E+06	.023	1.121	5.247	8.64662E-09
18	2.50000E+06	.029	1.147	5.185	1.17600E-08
19	4.02700E+06	.02	1.172	5.101	5.06581E-09
20	3.03000E+06	.021	1.192	5.306	6.83169E-09

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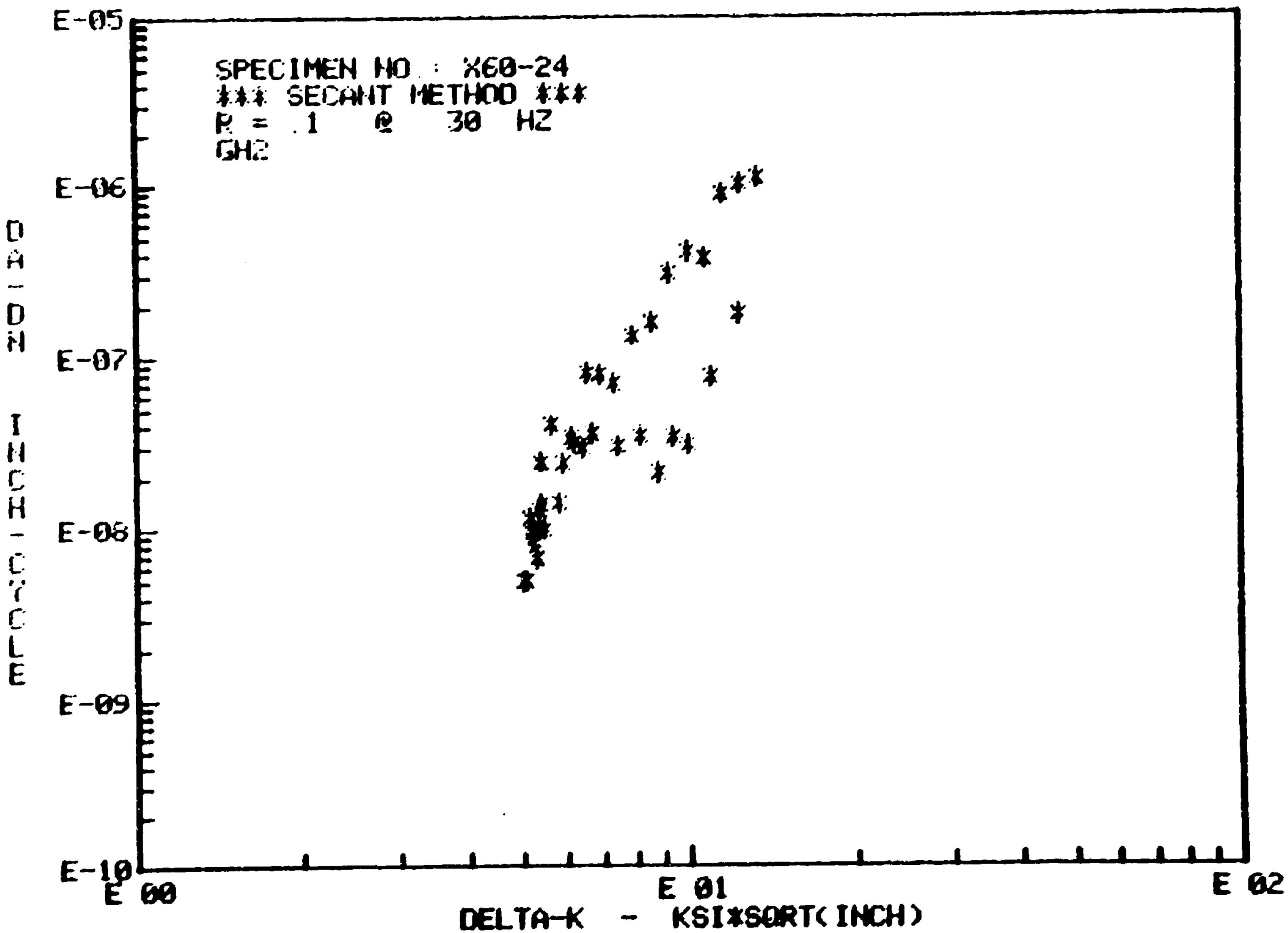
21	2.50000E+06	.025	1.215	5.369	9.87999E-09
22	830000	.021	1.237	5.434	2.46988E-08
23	500000	.021	1.258	5.673	4.10000E-08
24	850000	.02	1.278	5.93	2.41176E-08
25	700000	.023	1.3	6.221	3.21429E-08
26	270000	.022	1.322	6.547	8.07407E-08
27	300000	.024	1.345	6.916	8.00000E-08
28	350000	.025	1.369	7.348	7.11429E-08
29	250000	.033	1.398	7.922	1.32400E-07
30	150000	.024	1.427	8.563	1.60000E-07
31	100000	.03	1.454	9.258	3.65000E-07
32	50000	.021	1.48	9.995	4.19000E-07
33	60000	.023	1.501	10.695	3.75667E-07
34	25000	.022	1.524	11.511	8.89000E-07
35	20000	.02	1.545	12.38	1.01000E-06
36	20000	.022	1.566	13.355	1.10000E-06


SPECIMEN NO : X60-24
*** SECANT METHOD ***
R = .1 @ 30 HZ
GH2
DA/DN INCH/CYCLE
E-05
E-06
E-07
E-08
E-09
E-10
E 00
E 01
E 02
DELTA-K - KSI*SQRT(INCH)

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SPECIMEN NO.: X60-24
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .1 @ 30 HZ.
TEST ENVIRONMENT: GH2
DATA FILE : X6024 G.O. NUMBER 5230
2-23-81

OBS. NO.	DELTA-N	CRACK LENGTH (MM)	P-MAX (NEWTONS)	DELTA-A (MM)
1	120000	.549	6660	.549
2	257700	1.054	5772	.505
3	590000	1.516	5106	.462
4	750000	2.177	4662	.66
5	1.55000E+06	3.02	4218	.843
6	630000	3.584	3774	.564
7	800000	4.204	3330	.62
8	1.60000E+06	4.956	2775	.752
9	652000	5.55	2775	.594
10	1.87000E+06	6.452	2442	.902
11	2.00000E+06	7.178	2220	.726
12	2.68000E+06	7.869	1998	.691
13	2.30000E+06	8.699	1887	.831
14	1.92000E+06	9.332	1776	.632
15	2.25000E+06	9.881	1665	.549
16	3.98000E+06	10.389	1554	.508
17	2.66000E+06	10.973	1554	.584
18	2.50000E+06	11.72	1465.2	.747
19	4.02700E+06	12.238	1376.4	.518
20	3.03000E+06	12.763	1376.4	.526

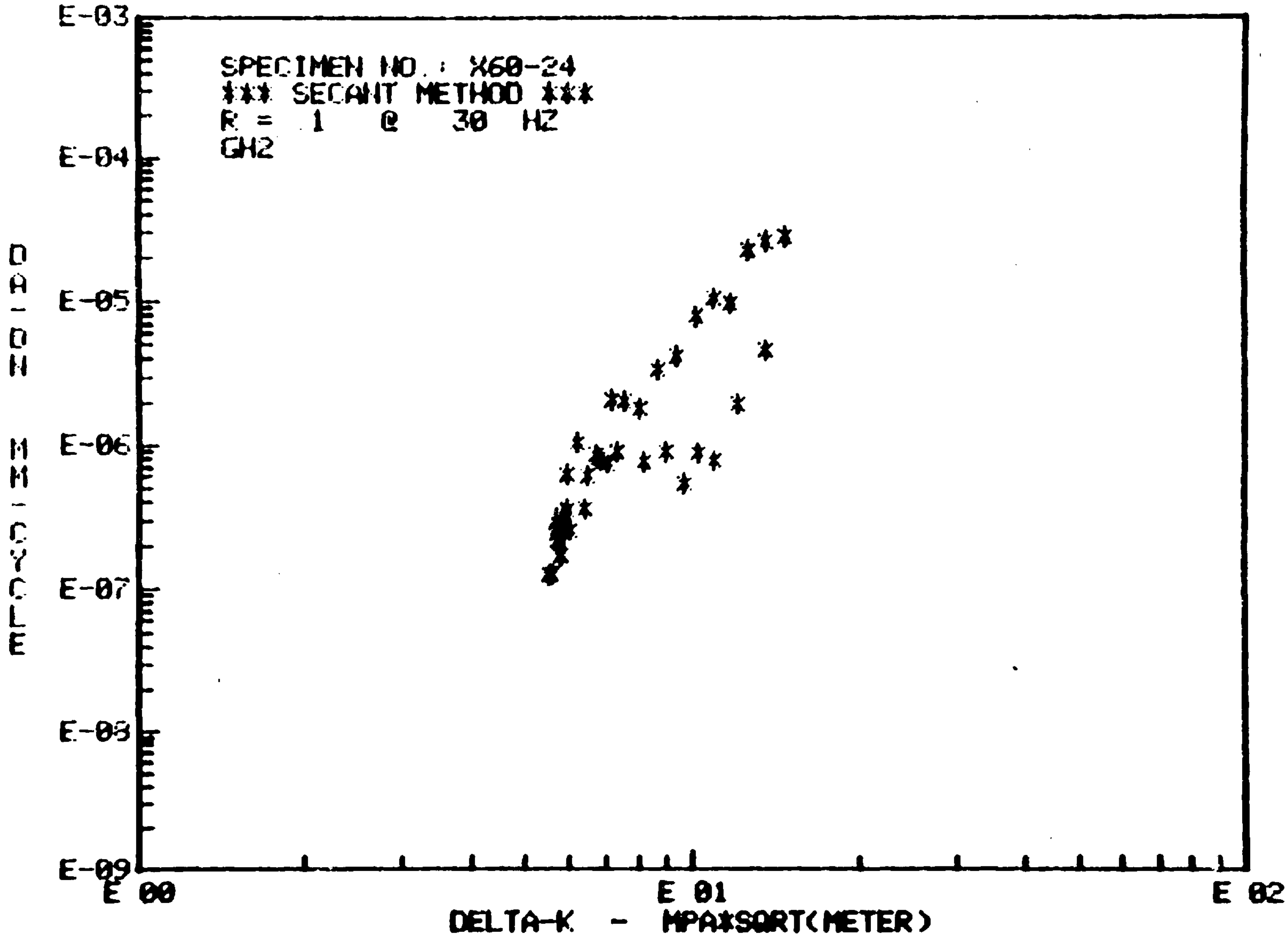
21	2.50000E+06	13.391	1332	.627
22	830000	13.912	1287.6	.521
23	500000	14.432	1287.6	.521
24	850000	14.953	1287.6	.521
25	700000	15.524	1287.6	.572
26	270000	16.078	1287.6	.554
27	300000	16.688	1287.6	.61
28	350000	17.32	1287.6	.632
29	250000	18.161	1287.6	.641
30	150000	18.771	1287.6	.61
31	100000	19.545	1287.6	.775
32	50000	20.066	1287.6	521
33	60000	20.64	1287.6	.574
34	25000	21.204	1287.6	.564
35	20000	21.717	1287.6	513
36	20000	22.276	1287.6	559

*** SECANT METHOD ***

SPECIMEN NUMBER: X60-24
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .1 @ 30 HZ.
TEST ENVIRONMENT: GH2
DATA FILE : X6024 G.O. NUMBER: 5230

OBS. NUMBER	DELTA-N	DELTA-A (MM)	A (MM)	DELTA-K MPA*SQRT(METER)	DA/DN (MM/CYCLE)
1	120000	.549	18.054	13.5718	4.57200E-06
2	257700	.505	18.581	12.021	1.96143E-06
3	590000	.462	19.065	10.9538	7.83525E-07
4	750000	.66	19.627	10.2932	8.80533E-07
5	1.55000E+06	.843	20.378	9.68256	5.44051E-07
6	630000	.564	21.082	8.98916	8.95047E-07
7	800000	.62	21.674	8.18541	7.74700E-07
8	1.00000E+06	.752	22.36	7.07692	7.51840E-07
9	652000	.594	23.033	7.34649	9.11595E-07
10	1.03000E+06	.902	23.781	6.74325	8.75436E-07
11	2.00000E+06	.726	24.595	6.42597	3.63220E-07
12	2.68000E+06	.691	25.303	6.03258	2.57791E-07
13	2.30000E+06	.831	26.064	5.9694	3.61122E-07
14	1.92000E+06	.632	26.796	5.88436	3.29407E-07
15	2.25000E+06	.549	27.386	5.73295	2.43840E-07
16	3.98000E+06	.508	27.915	5.5431	1.27638E-07
17	2.66000E+06	.584	28.461	5.75466	2.19624E-07
18	2.50000E+06	.747	29.126	5.6871	2.98704E-07
19	4.02700E+06	.518	29.759	5.59503	1.28672E-07
20	3.03000E+06	.526	30.281	5.81928	1.73525E-07

21	2.50000E+06	.627	30.657	5.88909	2.50952E-07
22	830000	.521	31.431	5.96048	6.27349E-07
23	500000	.521	31.952	6.22231	1.04140E-06
24	850000	.521	32.473	6.50417	6.12587E-07
25	700000	.572	33.019	6.82364	8.16430E-07
26	270000	.554	33.581	7.18123	2.05082E-06
27	300000	.61	34.163	7.58504	2.03199E-06
28	350000	.632	34.784	8.05953	1.80703E-06
29	250000	.841	35.521	8.68919	3.36296E-06
30	150000	.61	36.246	9.39212	4.06400E-06
31	100000	.775	36.938	10.1541	7.74698E-06
32	50000	.521	37.586	10.9627	1.04140E-05
33	60000	.574	38.133	11.7309	9.56736E-06
34	25000	.564	38.702	12.6258	2.25552E-05
35	20000	.513	39.24	13.5787	2.56540E-05
36	20000	.559	39.776	14.6475	2.79403E-05


SPECIMEN NO. : X60-24
*** SECANT METHOD ***
R = 1 @ 30 HZ
GH2
E-03
E-04
E-05
E-06
E-07
E-08
E-09
E 00
E 01
E 02
DELTA-K - MPA*SQRT(METER)
DA/DN MM/CYCLE

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H_2; R = 0.5

SPECIMEN NO.: X60-26
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .5 @ 30 HZ.
TEST ENVIRONMENT: H2
DATA FILE : X6026 G.O. NUMBER: 5230
4-22-81

OBS. NO.	DELTA-N	CRACK LENGTH (INCH)	P-MAX (KIPS)	DELTA-A (INCH)
1	303000	.091	1.5	025
2	405000	.117	1.3	.026
3	560000	.144	1.1	027
4	500000	.17	1	026
5	700000	.197	.9	.027
6	765000	.215	.8	.019
7	865000	.237	725	.021
8	1.22000E+06	.26	.65	023
9	1.46000E+06	.282	.6	022
10	2.00000E+06	.305	.55	024
11	3.60000E+06	.332	.5	027
12	2.50000E+06	.357	.475	.025
13	2.70000E+06	.377	.45	.02
14	1.24000E+06	.414	.8	.036
15	2.20000E+06	.582	7	.169
16	160000	.604	.55	.022
17	305000	.651	.55	.047
18	200000	.674	.45	.023
19	350000	.699	.35	.025
20	500000	.71	.3	.012

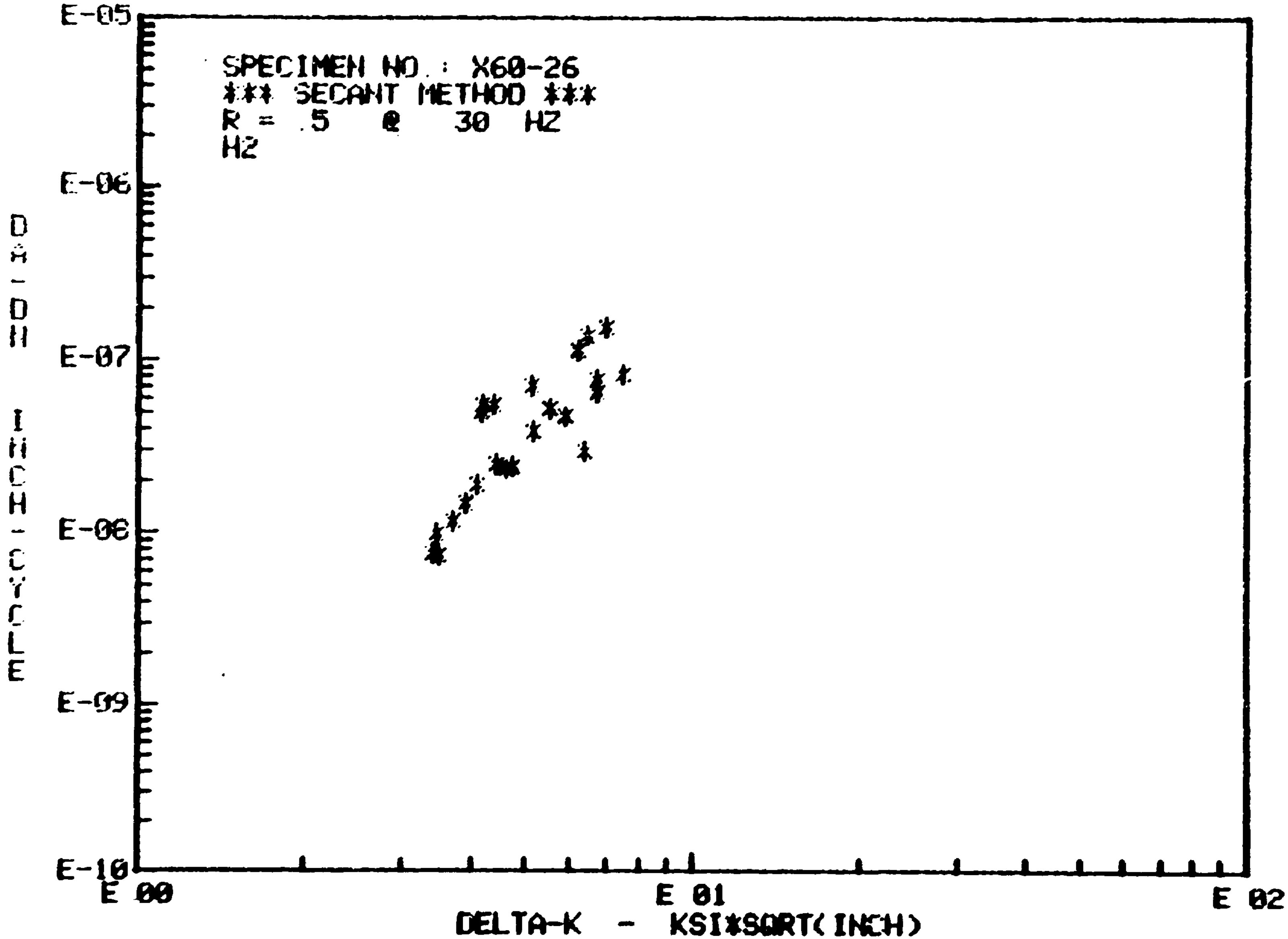
21	1.50000E+06	.793	.25	.083
22	598000	.826	.2	.033
23	2.50000E+06	.951	.15	.125

*** SECANT METHOD ***

SPECIMEN NUMBER: X60-26
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .5 @ 30 HZ.
TEST ENVIRONMENT: H2
DATA FILE : X6026 G.O. NUMBER 5230

OBS. NUMBER	DELTA-N	DELTA-A (INCH)	A (INCH)	DELTA-K KSI*SQRT(INCH)	DA/DN INCH/CYCLE
1	303000	.025	.779	7.505	8.22914E-08
2	405000	.026	.804	6.727	6.46477E-08
3	560000	.027	.83	5.896	4.73258E-08
4	500000	.025	.857	5.553	5.19400E-08
5	700000	.027	.883	5.184	3.87000E-08
6	765000	.019	.906	4.758	2.42614E-08
7	865000	.021	.926	4.436	2.48137E-08
8	1.22000E+06	.023	.948	4.109	1.92385E-08
9	1.46000E+06	.022	.971	3.922	1.47719E-08
10	2.00000E+06	.024	.994	3.72	1.17560E-08
11	3.60000E+06	.027	1.019	3.516	7.46445E-09
12	2.50000E+06	.025	1.045	3.481	9.99399E-09
13	2.70000E+06	.02	1.067	3.422	7.52371E-09
14	1.24000E+06	.036	1.096	6.382	2.94073E-08
15	2.20000E+06	.169	1.198	6.735	7.66082E-08
16	160000	.022	1.293	6.459	1.36425E-07
17	305000	.047	1.328	6.988	1.52580E-07
18	200000	.023	1.362	6.22	1.13645E-07
19	350000	.025	1.386	5.142	7.13030E-08
20	500000	.012	1.404	4.627	2.37080E-08

21	1.50000E+06	.083	1.452	4.4	5.50067E-08
22	598000	.033	1.509	4.207	5.51704E-08
23	2.50000E+06	.125	1.588	4.174	4.99292E-08



SPECIMEN NO. : X60-26
*** SECANT METHOD ***
R = .5 @ 30 HZ
H2
E-05
E-06
E-07
E-08
E-09
E-10
DA-DN INCH-CYCLE
E 00
E 01
E 02
DELTA-K - KSI*SQRT(INCH)

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SPECIMEN NO.: X60-26
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .5 @ 30 HZ.
TEST ENVIRONMENT: H2
DATA FILE : X6026 G.O. NUMBER: 5230
4-22-81

OBS NO.	DELTA-N	CRACK LENGTH (MM)	P-MAX (NEWTONS)	DELTA-A (MM)
1	303000	2.311	6660	.633
2	405000	2.976	5772	.665
3	560000	3.649	4884	.673
4	500000	4.309	4440	.66
5	700000	4.997	3996	.688
6	765000	5.468	3552	.471
7	865000	6.014	3219	.545
8	1.22000E+06	6.61	2886	.596
9	1.46000E+06	7.158	2664	.548
10	2.00000E+06	7.755	2442	.597
11	3.60000E+06	8.438	2220	.683
12	2.50000E+06	9.072	2109	.635
13	2.70000E+06	9.588	1998	.516
14	1.24000E+06	10.514	3552	.926
15	2.20000E+06	14.795	3108	4.281
16	169000	15.35	2442	.554
17	305000	16.532	2442	1.182
18	200000	17.109	1998	.577
19	350000	17.743	1554	.634
20	500000	18.044	1332	.301

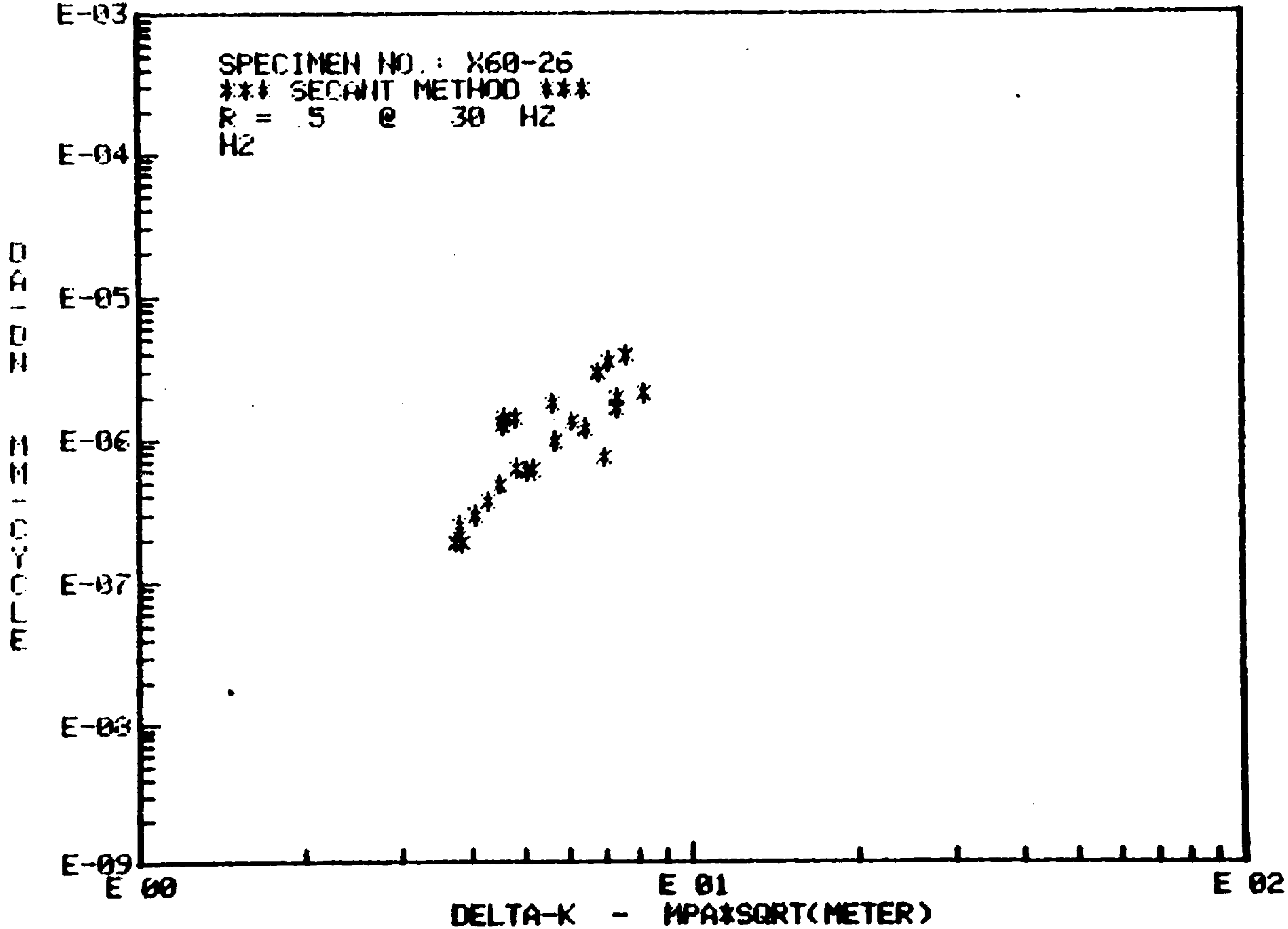
21	1.50000E+06	20.14	1110	2.096
22	598000	20.977	888	.837
23	2.50000E+06	24.148	666	3.171

*** SECANT METHOD ***

SPECIMEN NUMBER: X60-26
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .5 @ 30 HZ.
TEST ENVIRONMENT: H2
DATA FILE : X6026 G.O. NUMBER: 5230

OBS. NUMBER	DELTA-N	DELTA-A (MM)	A (MM)	DELTA-K MPA*SQRT(METER)	DA/DN (MM/CYCLE)
1	303000	.633	19.774	8.2317	2.09020E-06
2	405000	.665	20.424	7.37838	1.64205E-06
3	560000	.673	21.093	6.46646	1.20210E-06
4	500000	.66	21.759	6.09169	1.31928E-06
5	700000	.688	22.433	5.68588	9.82990E-07
6	765000	.471	23.013	5.21837	6.16240E-07
7	865000	.545	23.521	4.86595	6.30419E-07
8	1.22000E+06	.596	24.092	4.50711	4.88658E-07
9	1.46000E+06	.548	24.664	4.30141	3.75207E-07
10	2.00000E+06	.597	25.236	4.07967	2.98653E-07
11	3.60000E+06	.683	25.876	3.85637	1.89537E-07
12	2.50000E+06	.635	26.535	3.81787	2.53848E-07
13	2.70000E+06	.516	27.11	3.75336	1.91102E-07
14	1.24000E+06	.926	27.831	6.99936	7.46944E-07
15	2.20000E+06	4.281	30.435	7.387	1.94585E-06
16	160000	.554	32.852	7.0843	3.46519E-06
17	305000	1.182	33.721	7.6649	3.87554E-06
18	200000	.577	34.6	6.82261	2.88658E-06
19	350000	.634	35.206	5.63933	1.81110E-06
20	500000	.301	35.673	5.07473	6.02180E-07

21	1.50000E+06	2.096	36.872	4.82621	1.39717E-06
22	598000	.837	38.338	4.61374	1.40031E-06
23	2.50000E+06	3.171	40.342	4.57783	1.26820E-06


SPECIMEN NO.: X60-26
*** SECANT METHOD ***
R = .5 @ 30 HZ
H2
DA/DN MM/CYCLE
E-03
E-04
E-05
E-06
E-07
E-08
E-09
E 00
E 01
E 02
DELTA-K - MPA*SQRT(METER)

H_2; R = 0.8

SPECIMEN NO.: X60-23
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .8 @ 30 HZ.
TEST ENVIRONMENT: HYDROGEN
DATA FILE : X6023 G.O. NUMBER: 5230
12-22-80

OBS. NO.	DELTA-N	CRACK LENGTH (INCH)	P-MAX (KIPS)	DELTA-A (INCH)
1	900000	.086	4.5	.043
2	475000	.135	4.1	.049
3	420000	.179	3.5	.044
4	465000	.217	3.15	.033
5	600000	.25	2.825	.033
6	700000	.29	2.54	.04
7	950000	.334	2.3	.044
8	900000	.375	2	.041
9	1.39600E+06	.421	1.7	.046
10	2.36000E+06	.441	1.45	.02
11	800000	.462	1.3	.02
12	790000	.482	1.17	.02
13	2.07500E+06	.502	1.025	.021
14	1.30000E+06	.523	.975	.021
15	2.12000E+06	.552	.88	.029
16	2.58500E+06	.573	.82	.021
17	3.87800E+06	.593	.74	.02
18	4.30090E+06	.62	.7	.027
19	1.08430E+06	.642	.665	.022
20	1.98260E+06	.658	.62	.016

21	2.90000E+06	.675	.58	.017
22	1.79060E+06	.694	.54	.019
23	3.00000E+06	.718	.5	.024
24	2.80200E+06	.739	.46	.021
25	6.22000E+06	.76	.42	.021
26	800000	.778	.42	.019
27	2.05000E+06	.799	.42	.02
28	1.35000E+06	.818	.42	.02
29	1.00000E+06	.838	.42	.019
30	1.00000E+06	.863	.42	.025
31	500000	.884	.42	.021
32	465000	.905	.42	.021
33	450000	.926	.42	.021
34	345000	.947	.42	.022
35	350000	.97	.42	.023
36	350000	.998	.42	.028
37	350000	1.039	.42	.041
38	120000	1.061	.42	.022
39	100000	1.083	.42	.022
40	100000	1.108	.42	.025

41	70000	1.129	.42	.021
42	40000	1.152	.42	.022
43	40000	1.176	.42	.025
44	35000	1.199	.42	.022
45	25000	1.242	.42	.044

*** SECANT METHOD ***

SPECIMEN NUMBER: X60-23
DIMENSION (INCH): B = .5 W = 2
2H = 2.4 A(N) = .7
R-RATIO = .6 @ 30 HZ.
TEST ENVIRONMENT: HYDROGEN
DATA FILE : X6023 G.O. NUMBER: 5230

OBS. NUMBER	DELTA-N	DELTA-A (INCH)	A (INCH)	DELTA-K KSI*SQRT(INCH)	DA/DN INCH/CYCLE
1	230000	.043	.764	8.84	4.76514E-08
2	475000	.049	.81	8.558	1.04208E-07
3	420000	.044	.857	7.770	1.03693E-07
4	465000	.038	.898	7.407	8.20645E-08
5	600000	.033	.934	6.99	5.53600E-08
6	700000	.04	.97	6.632	5.72500E-08
7	950000	.044	1.012	6.404	4.65435E-08
8	900000	.041	1.055	5.96	4.54589E-08
9	1.39000E+06	.046	1.098	5.447	3.28249E-08
10	2.38000E+06	.02	1.131	4.923	8.57395E-09
11	800000	.02	1.152	4.58	2.53100E-08
12	790000	.02	1.172	4.28	2.54532E-08
13	2.07500E+06	.021	1.192	3.898	9.96953E-09
14	1.30000E+06	.021	1.213	3.862	1.58408E-08
15	2.12000E+06	.029	1.237	3.664	1.35453E-08
16	2.58500E+06	.021	1.262	3.598	8.18182E-09
17	3.87800E+06	.02	1.283	3.395	5.09953E-09
18	4.30090E+06	.027	1.306	3.386	6.34913E-09
19	1.08430E+06	.022	1.331	3.407	2.02020E-08
20	1.98260E+06	.016	1.35	3.325	7.96834E-09

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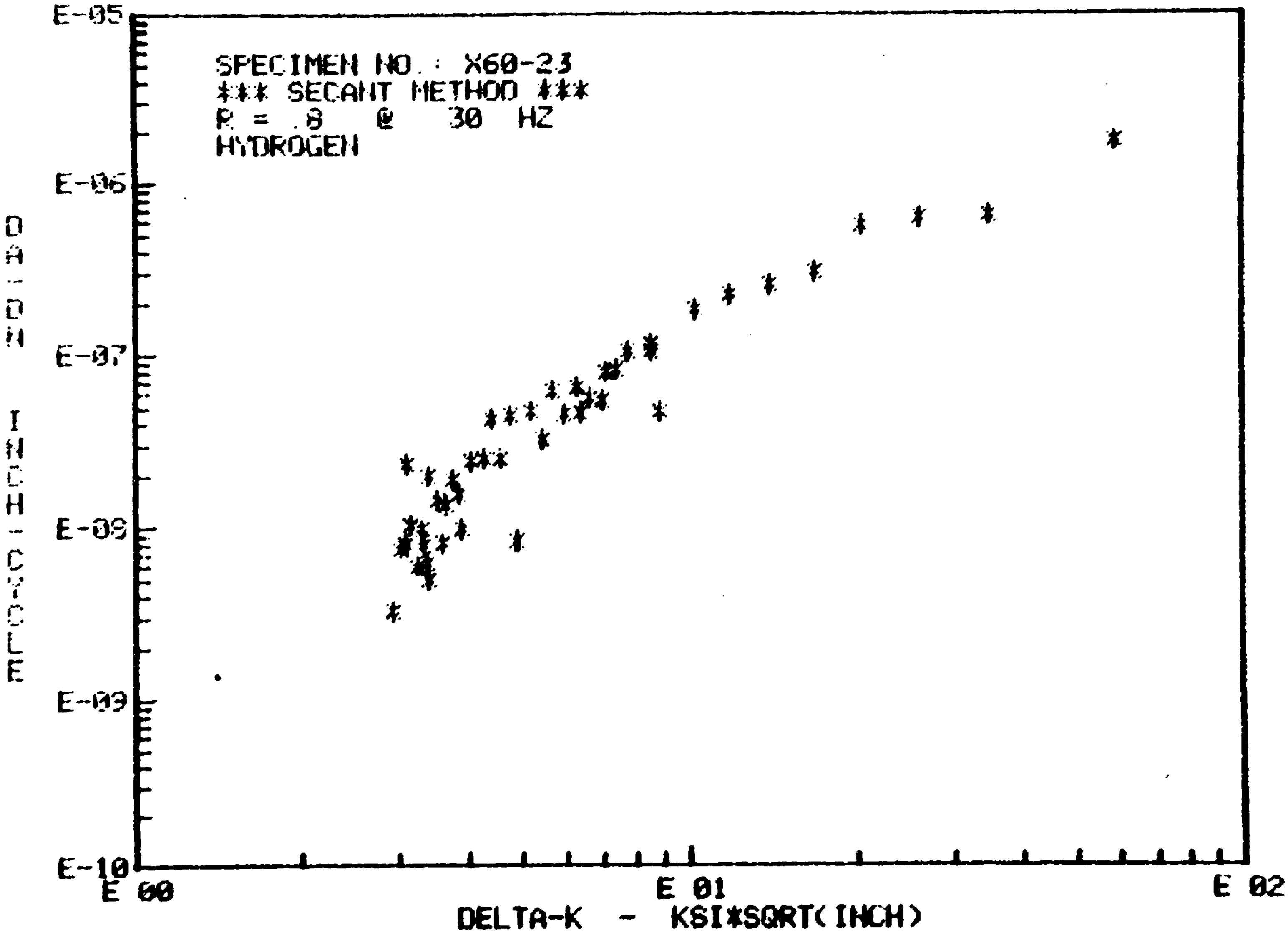
21	2.90000E+06	.017	1.366	3.24	5.94345E-09
22	1.79060E+06	.019	1.384	3.159	1.04468E-08
23	3.00000E+06	.024	1.406	3.096	8.14035E-09
24	2.80200E+06	.021	1.429	3.032	7.53603E-09
25	6.22000E+06	.021	1.45	2.939	3.31126E-09
26	800000	.019	1.469	3.114	2.33000E-08
27	2.05000E+06	.02	1.489	3.306	9.89074E-09
28	1.35000E+06	.02	1.509	3.524	1.46459E-08
29	1.00000E+06	.019	1.526	3.76	1.92520E-08
30	1.00000E+06	.025	1.55	4.059	2.47830E-08
31	500000	.021	1.573	4.414	4.26899E-08
32	465000	.021	1.594	4.786	4.49097E-08
33	450000	.021	1.615	5.208	4.70934E-08
34	345000	.022	1.637	5.702	6.23912E-08
35	350000	.023	1.659	6.297	6.48200E-08
36	350000	.028	1.684	7.113	8.02371E-08
37	350000	.041	1.719	8.524	1.16317E-07
38	120000	.022	1.75	10.24	1.80999E-07
39	100000	.022	1.772	11.807	2.21100E-07
40	100000	.025	1.795	13.985	2.52200E-07

41	70000	.021	1.819	16.827	3.01429E-07	*
42	40000	.022	1.84	20.469	5.59998E-07	*
43	40000	.025	1.864	26.123	6.18002E-07	*
44	35000	.022	1.887	34.856	6.36571E-07	*
45	25000	.044	1.92	58.943	1.74880E-06	*


SPECIMEN NO. : X60-23
*** SECANT METHOD ***
R = .8 @ 30 HZ
HYDROGEN
DA/DN INCH/CYCLE
E-05
E-06
E-07
E-08
E-09
E-10
E 00
E 01
E 02
DELTA-K - KSI*SQRT(INCH)

SPECIMEN NO.: X60-23
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .8 @ 30 HZ.
TEST ENVIRONMENT: HYDROGEN
DATA FILE : X6023 G.O. NUMBER: 5230
12-22-80

OBS. NO.	DELTA-N	CRACK LENGTH (MM)	P-MAX (NEWTONS)	DELTA-A (MM)
1	900000	2.176	19980	1.089
2	475000	3.434	18204	1.257
3	420000	4.54	15540	1.106
4	465000	5.509	13986	.969
5	600000	6.353	12543	.844
6	700000	7.371	11277.6	1.018
7	950000	8.494	10212	1.123
8	900000	9.533	8680	1.039
9	1.39000E+06	10.694	7548	1.161
10	2.78000E+06	11.213	6438	.518
11	800000	11.727	5772	.514
12	790000	12.238	5194.8	.511
13	2.07500E+06	12.763	4551	.525
14	1.30000E+06	13.286	4329	.523
15	2.12000E+06	14.016	3907.2	.729
16	2.58500E+06	14.553	3640.8	.537
17	3.87800E+06	15.055	3285.6	.502
18	4.30090E+06	15.749	3108	.694
19	1.08430E+06	16.305	2952.6	.556
20	1.98260E+06	16.706	2752.8	.401

21	2.90000E+06	17.144	2575.2	.438
22	1.79060E+06	17.619	2397.6	.475
23	3.00000E+06	18.24	2220	.62
24	2.80200E+06	18.776	2042.4	.536
25	6.22000E+06	19.299	1864.8	.523
26	800000	19.773	1864.8	.473
27	2.05000E+06	20.288	1864.8	.515
28	1.35000E+06	20.79	1864.8	.502
29	1.00000E+06	21.279	1864.8	.489
30	1.00000E+06	21.908	1864.8	.629
31	500000	22.451	1864.8	.542
32	465000	22.981	1864.8	.53
33	450000	23.519	1864.8	.538
34	345000	24.066	1864.8	.547
35	350000	24.642	1864.8	.576
36	350000	25.356	1864.8	.713
37	350000	26.39	1864.8	1.034
38	120000	26.941	1864.8	.552
39	100000	27.503	1864.8	.562
40	100000	28.143	1864.8	.641

41	70000	28.679	1864.8	.536
42	40000	29.248	1864.8	.569
43	40000	29.876	1864.8	.628
44	35000	30.442	1864.8	.566
45	25000	31.553	1864.8	1.11

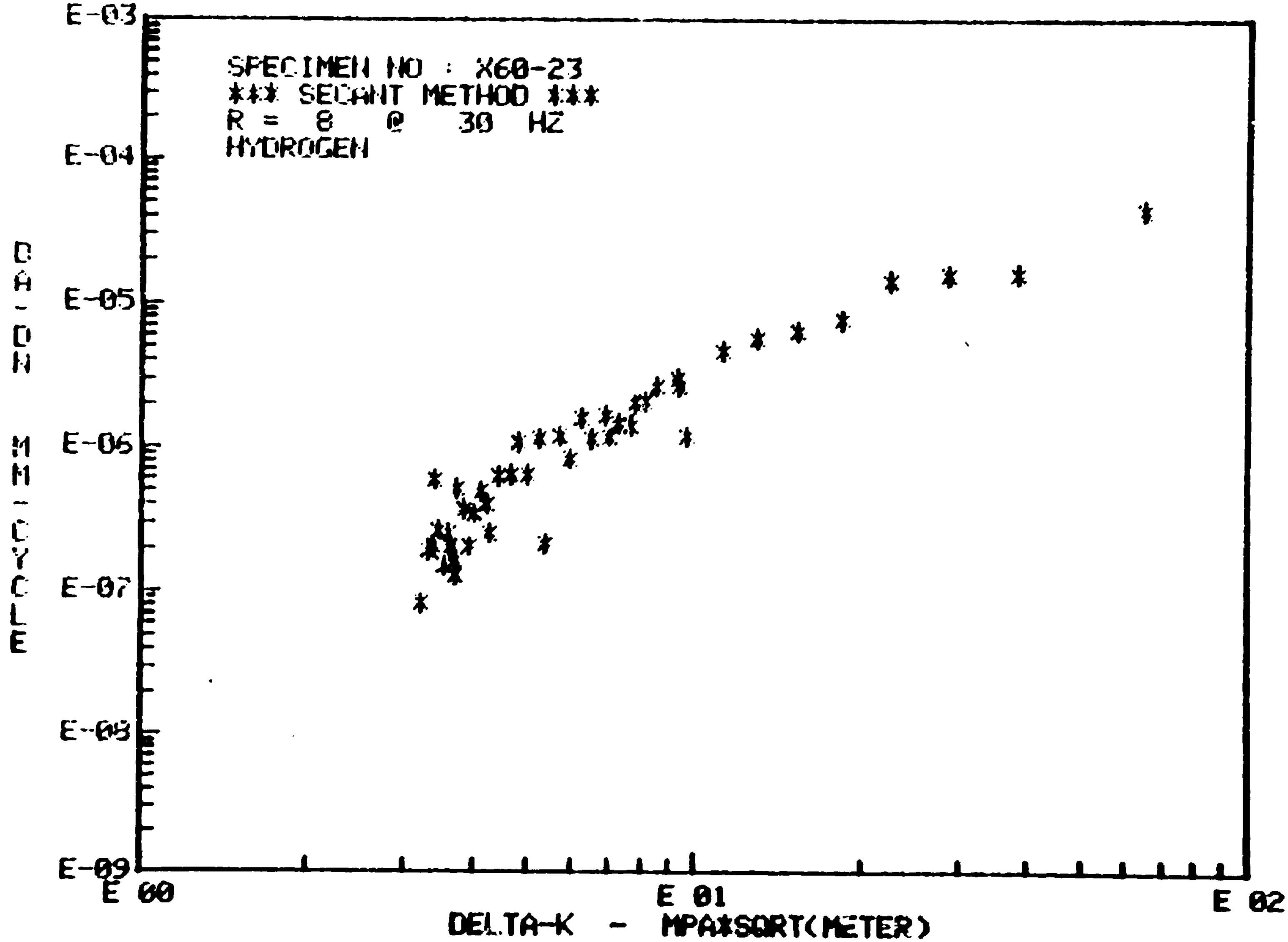
*** SECANT METHOD ***

SPECIMEN NUMBER: X60-23
DIMENSION (METER): B = .0127 W = .0508
2H = .06096 A(N) = .01778
R-RATIO = .8 @ 30 HZ.
TEST ENVIRONMENT: HYDROGEN
DATA FILE : X6023 G.O. NUMBER: 5230

OBS. NUMBER	DELTA-N	DELTA-A (MM)	A (MM)	DELTA-K MPA*SQRT(METER)	DA/DN (MM/CYCLE)
1	900000	1.089	19.412	9.69548	1.21035E-06
2	475000	1.257	20.585	9.38694	2.64688E-06
3	420000	1.106	21.767	8.53104	2.63350E-06
4	465000	.969	22.805	8.12455	2.08444E-06
5	600000	.844	23.711	7.66632	1.40614E-06
6	700000	1.018	24.642	7.27427	1.45415E-06
7	950000	1.123	25.712	7.02445	1.18236E-06
8	900000	1.039	26.794	6.53728	1.15465E-06
9	1.39000E+06	1.161	27.894	5.97458	8.35276E-07
10	2.39000E+06	.518	28.733	5.4	2.17778E-07
11	800000	.514	29.25	5.02313	6.42874E-07
12	790000	.511	29.762	4.69386	6.46639E-07
13	2.07500E+06	.525	30.28	4.27575	2.53228E-07
14	1.30000E+06	.523	30.805	4.23569	4.02355E-07
15	2.12000E+06	.729	31.431	4.01921	3.44051E-07
16	2.58500E+06	.537	32.064	3.94688	2.07818E-07
17	3.87800E+06	.502	32.584	3.72394	1.29528E-07
18	4.30090E+06	.694	33.182	3.71414	1.61268E-07
19	1.08430E+06	.556	33.807	3.73698	5.13130E-07
20	1.98260E+06	.401	34.286	3.64639	2.02396E-07

21	2.90000E+06	.438	34.705	3.55407	1.50963E-07
22	1.79060E+06	.475	35.162	3.46453	2.65348E-07
23	3.00000E+06	.62	35.709	3.39605	2.06765E-07
24	2.80200E+06	.536	36.288	3.32596	1.91416E-07
25	6.22000E+06	.523	36.817	3.22392	8.41058E-08
26	800000	.473	37.316	3.41585	5.91819E-07
27	2.05000E+06	.515	37.81	3.6263	2.51225E-07
28	1.35000E+06	.502	38.319	3.86568	3.72006E-07
29	1.00000E+06	.489	38.814	4.12453	4.89153E-07
30	1.00000E+06	.629	39.374	4.45178	6.29490E-07
31	500000	.542	39.959	4.84169	1.08432E-06
32	465000	.53	40.496	5.24909	1.14671E-06
33	450000	.538	41.03	5.7126	1.36617E-06
34	345000	.547	41.573	6.25413	1.56474E-06
35	350000	.576	42.134	6.90674	1.64643E-06
36	350000	.713	42.779	7.80165	2.07802E-06
37	350000	1.034	43.653	9.3487	2.95446E-06
38	120000	.552	44.445	11.2311	4.59738E-06
39	100000	.562	45.002	12.9496	5.61594E-06
40	100000	.641	45.603	15.3385	6.40559E-06 *

41	70000	.536	46.191	18.4563	7.65632E-06	*
42	40000	.569	46.744	22.4502	1.42239E-05	*
43	40000	.628	47.342	28.6517	1.56972E-05	*
44	35000	.566	47.939	38.2306	1.61689E-05	*
45	25000	1.11	48.777	64.6496	4.44195E-05	*



SPECIMEN NO : X60-23
*** SECANT METHOD ***
R = 8 @ 30 HZ
HYDROGEN
DA/DN MM/CYCLE
E-03
E-04
E-05
E-06
E-07
E-08
E-09
E 00
E 01
E 02
DELTA-K - MPA*SQRT(METER)

SC5230.17FR